

GRASSES AND CLOVERS,
FIELD ROOTS,
FORAGE AND FODDER PLANTS.

WRITTEN BY

PROF. THOMAS SHAW,

FOR

NORTHROP, BRASLAN, GOODWIN CO.
MINNEAPOLIS, MINN.

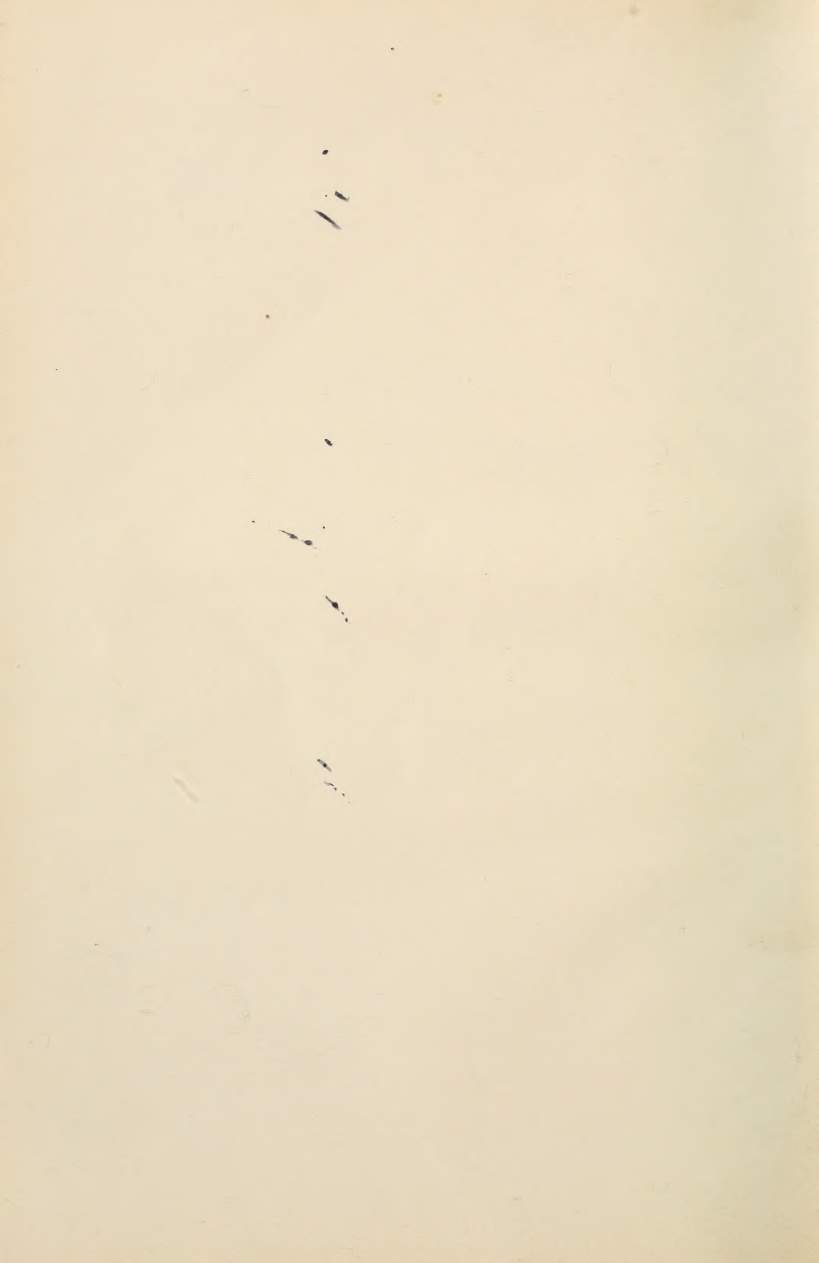
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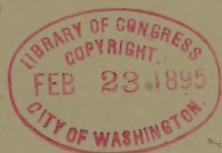
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GRASSES
AND CLOVERS



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FIELD ROOTS

FORAGE

AND

FODDER

PLANTS

WRITTEN BY

PROFESSOR THOMAS SHAW,

Of the University of Minnesota.

MINNEAPOLIS, MINN.
MOFFETT, THURSTON & PLANK PTG. CO.
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PUBLISHERS' PREFACE.

Every season we are in receipt of a great many letters asking information on the subjects which are discussed in this book. In our desire to answer these questions correctly and in a manner that would be useful to our correspondents, it became apparent to us, as it has no doubt been clear to nearly everyone who operates a farm, that there was no book in existence that handled these important subjects in a really clear and practical manner. We determined to have such a book. The next question with us was, whom should we get to write it. There are some writers who know a good deal, but cannot tell it. There are others who write a good deal but do not know it. What we were after was a man who knew and could tell it in a way that would be readily understood by everyone who could read. We finally fixed on such a man, Professor Thomas Shaw, a thorough student, a practical farmer, and one who possesses in a rare degree the gift of imparting information in such a manner as to interest and instruct every one who reads. We said to Professor Shaw, "We want a book that will enable the farmer who consults it to decide:

First—What is best for his land and purpose.

Second—How to prepare his ground.

Third—How to sow the seed.

Fourth—How to take care of the crop.

Fifth—How to harvest it.

Sixth—How to feed it."

We will leave it to the reader to judge as to how well Professor Shaw and ourselves have succeeded in the work as it stands.

This book should prove interesting and instructive to farmers everywhere, but it will be found of especial value throughout the Northwest. We have faith in the future of the Northwest. We believe that out of the conditions that have prevailed during the last few years, it will arise stronger than ever before. The low price of wheat will compel attention to other crops. Great changes have

already taken place. In our experience in the seed business in Minnesota, covering a period of something over ten years, we can see already a great advancement. Ten years ago it was not thought possible to raise any good variety of corn in Minnesota, outside of the southern tier of counties. The variety in common use in the immediate vicinity of Minneapolis was a small-eared, shallow corn called the "Michigan Row Dent," which was in fact nearly a flint. At the present time this variety has been altogether discarded, having given place to such well-known sorts as the Minnesota King, Pride of the North, Dakota Dent, etc., and it will not be more than a year or two when these will be superseded by even better varieties which have been brought from the South gradually by us so as to acclimate them to this climate. In less than five years' time, the state of Minnesota will be growing as good corn, as large corn, and as many bushels to the acre as are now produced in the states of Iowa, Illinois and Nebraska. A few years ago, the only variety of corn that was known, or that was thought possible to be produced in North Dakota was the Squaw Corn. In its place we now have varieties like the Minnesota King, Mercer, Pride of Dakota, etc., which not only give a large yield of ears but an abundance of fodder. We take considerable satisfaction in the thought that we have been instrumental in acclimating and introducing most of these varieties into the Northwest. Not many years ago it was thought impossible that timothy and clover could thrive in Minnesota. To-day Minnesota grown seed of these varieties commands the highest price amongst seed buyers, all over the United States. It is such facts as these that lead us to look confidently to more rapid developments even, owing to the pressure necessity exerts.

We should be pleased to hear from all those who read this book, as to how well it meets their views and needs.

Very truly,

NORTHRUP, BRASLAN, GOODWIN CO.

Minneapolis, Minn., January 1, 1895.

PREFATORY NOTE.

This book was written for the publishers at their request and with the sanction and approval of the Agricultural Committee of the Board of Regents of the State of Minnesota. It is intended to supply in some degree the great dearth of practical literature on the subjects of which it treats. When writing it, the Author's aim was to render it helpful to the farmers of this Republic, and more especially to those located in the newer sections thereof, where experience in growing many valuable farm products is as yet very limited, and in some instances entirely wanting.

THOMAS SHAW.

UNIVERSITY EXPERIMENT STATION, }
ST. ANTHONY PARK, Minn., Dec., '94. }

GRASSES AND FORAGE PLANTS.

CHAPTER I.

THE GREAT IMPORTANCE RELATIVELY OF GRASS, FORAGE, FODDER AND ROOT CROPS.

The grass crop of the world is the most important crop by far that mother earth produces. No other crop is so necessary to the sustenance of the various forms of animal life, nor is there any which covers so large an area. Even in rich, arable sections distinguished for growing cereals there is usually a larger area devoted to grass than to any other variety of crop. And here it may be mentioned that the term grass is meant to include all the varieties of clover.

In no other way can soil fertility and soil moisture be so easily maintained as by growing grass in one or the other of its various forms, and in no other way can the comparative density of the soil be kept so perfectly in equilibrium. It follows, therefore, that more attention should be given relatively to the growing of grasses than to the growing of other crops.

But there are special reasons why the grass crop should receive most careful attention at the hands of the farmers in that section of the United States and Canada, usually spoken of as the Northwest. These grow out of the comparative dryness of the climate in that region, the relatively small yields furnished by the upland native prairie, the dry and woody character of the grasses which grow upon it during the whole of the autumn, the much larger yields that will be obtained from certain varieties of the cultivated grasses, and the greater power which some of these possess to crowd out nearly all forms of noxious weed life.

While it is well to recognize the fact that some kinds of grass will always grow more shyly and less luxuriantly in the Northwest than in

a more humid climate, it should be remembered that many kinds of grass can be introduced with great advantage in addition to those now grown. These varieties will be mentioned in a subsequent chapter. In the meantime every farmer should be testing them for himself to ascertain which kinds will best suit his soil and climate. He should introduce them at first with a prudent caution until he has satisfied himself that they have staying qualities. This once assured, they may be grown to any extent desired.

The term **forage crops** includes such crops as are grown for pasture or for summer feeding in addition to the grasses proper, as for instance rye eaten off fall and spring, rape eaten off when desired, and mixed grains grown and cut and fed while yet green. There is a peculiar propriety in growing these crops in the Northwest owing to the dryness of the climate and to the lack of succulence in the grasses in consequence at certain seasons of the year. In the judgment of the writer the successful growing of forage crops to supplement the pastures when these are dry is the most important consideration that can engage the attention of the producer of live stock. Every one thus engaged is deeply interested in this problem and should at once set to work in solving it for himself and more or less on the lines laid down in Chapter IV of this book.

To secure a vigorous germination at certain seasons of the year is the one real difficulty to be overcome in the growing of these forage crops. But many of them may be planted or sown while there is yet sufficient moisture in the ground to attain this end. The amount of food which may thus be grown per acre where a due regard is had to adaptation is in many instances very great. And the forage crops mentioned in the chapter referred to, have nutritive and succulent properties admirably adapted to the needs of various classes of live stock.

Fodder crops are those crops which are grown for winter foods, exclusive of the grain taken out of the ear, and field roots, as mangels, turnips and potatoes. They include such crops as corn, millet and cereals cut at a stage which precludes the necessity for threshing them. These crops will be still more in demand in the Northwest as the land becomes occupied, and the areas for producing wild hay decrease in consequence. They usually produce more food per acre than hay, and in some seasons they can be grown so as to supplement a light grass crop.

Field roots include such crops as mangels, turnips and carrots. One variety or another of these can be grown in every section of the Northwest, and indeed in all the Northern and Middle States and in the Dominion of Canada from sea to sea. On suitable soils and when properly grown they produce an enormous amount of food per acre. And when fed as a part of the ration, more especially in the winter season, no other food adjunct is equal to them for keeping live stock in a healthy condition, or promoting their rapid development.



CHAPTER II.

CULTIVATED GRASSES AND CLOVERS

Grasses.

In this chapter only those varieties are discussed in detail which have been found suitable to the conditions of the Northwest, or in reference to which there is a strong likelihood that they will be found suitable to those conditions. It is more than probable that other varieties may yet be found adapted to this country, but the discussion of these at present would be foreign to the aim of this book.

Notwithstanding the important part that cultivated grasses and clovers will yet play in the agriculture of the Northwest, they should be discussed in the meantime with a prudent caution. But little is known positively regarding the adaptability of some of the different varieties, as several of them have not been sufficiently tested as yet; and where tests have been made in many instances the conditions were such that the conclusions reached have either possessed but little value or have been positively misleading. In a country so large, one variety for instance, may fail in one locality and prove a success in another where the conditions of soil and climate are different, and the opposite of this may also prove true. And in situations far apart where the soil conditions are exactly the same, very dissimilar results may be obtained in growing the same plants owing to a difference in climate.

Timothy.—Timothy (*Phleum pratense*) is so well known that it is not necessary to describe it. At present it stands crowned king of all the grasses. It is probably adapted to a wider range of conditions than any other variety of grass. No other variety is perhaps equal to it in average yields, nor does any other variety excel it in all round feeding value. It is best suited to rich, damp loam soils abounding in vegetable matter. On these soils the best crops can be grown when they lie upon a subsoil of average density. Clay loams are preferable

to sandy loams. Sandy soils produce light crops of timothy, and the lighter the sand the less adapted is it to the growth of timothy. Fair crops may be grown in some seasons on stiff clays.

Timothy may be sown alone in the early autumn or along with a crop of rye, or it may be sown early in the spring. In the autumn it should be sown in September alone or along with rye. When sown late in the spring it is much more liable to be destroyed by the dry weather of summer. The depth of the covering will depend on the nature of the soil, the humidity of the climate and the time of sowing. The lighter and more spongy the soil the deeper the covering required, and the more humid the climate, and the earlier in the spring that the seed is sown, the lighter will be the covering needed. When the weather is moist it is not necessary to cover the seed on heavy soils. On soils that do not shift with the wind the roller may provide a sufficient covering for seed sown in the spring, but for seed sown in the autumn it should never be thus used. On very spongy soils such as we sometimes find on the prairie, the seed may be buried to the depth of one inch or more.

Timothy can be sown by hand, with an attachment to the grain drill, or with seeders made for the purpose. The amount of seed required will vary with the soil conditions and with the extent to which it is grown in conjunction with other grasses. The richer the soil and the finer the tilth, the less the quantity of seed required. If sown alone, from 6 to 12 pounds of seed may be used. When sown with clover the amount of timothy seed required will vary with the relative proportion of each that may be sought, but from 4 to 6 pounds of timothy and from 6 to 8 pounds of clover are usually deemed sufficient.

Timothy is more commonly grown for hay than for pasture, but is very extensively raised for both uses. When grown for hay it may be grown alone or along with other grasses and clovers. On average soils it is frequently sown along with common red or mammoth clover and on low soils containing much vegetable matter with alsike clover. When timothy has reached full bloom it is ready to be cut for hay. It cures easily and if allowed to ripen its seeds the crop is cut with the binder. It is threshed with an ordinary threshing machine.

Timothy has proved itself well adapted to the Northwest. On prairie soils it seldom fails to make a "stand" when sown early in the season, under suitable conditions. But after it has been cut once or

twice it frequently becomes so thick in the bottom that it fails to give a large return in hay. When this takes place it should be ploughed under ; in other words, on prairie soils timothy meadows should be of short duration.

Unlike clover, timothy does not enrich the land but on prairie soils it accomplishes much good in another way. When a timothy meadow is broken up it brings much moisture to the soil which is of great benefit to the crop that comes after it. For this reason if for no other timothy should come frequently in the rotation on prairie soils.

Blue Grass.—Blue grass (*Poa pratensis*) is a perennial with creeping rootstocks. It is sometimes known as June grass, probably from the fact that in the northern hemisphere it matures its seeds in the month of June. It is also frequently called Kentucky blue grass. It seems to grow singularly well in Kentucky, hence probably the origin of the name. Indeed the term blue grass is a misnomer, as it properly belongs to a variety (*Poa compressa*) not nearly so widely distributed as June grass. The real blue grass, (*Poa compressa*) has a flat stem of a blue color and the leaves also have a blueish tinge. It does not mature its seeds for nearly a month after the other variety has been ripe, and moreover it weighs very heavily when made into hay, whereas the other variety (*Poa pratensis*) does not weigh so heavily, nor is it of so good feeding quality.

Blue grass (*Poa pratensis*) is very widely distributed. It seems to be a native of Europe, Asia and America. Over large portions of the North American continent it does not require to be sown it is so well established. Where forests have been cut away it will soon take possession of the soil without having been sown, and there is probably no grass in the northern part of the continent which can hold its own against blue grass, unless it be couch grass, which is usually looked upon as a weed.

Blue grass is gradually working westward and with occupancy of the lands, it puts in an appearance, although it does not come so readily in the open prairie as in those sections of the west naturally capable of growing timber. Nor does it grow so vigorously when it has been established. Nevertheless it is doubtless destined to overrun very much of the west in time, so that after land has been once cultivated and then allowed to run wild again, blue grass will be the variety which will take possession of such soils. Its advent in the North-

west should be encouraged, for, though it has some weak points, it is much superior to the native prairie as a pasture.

Blue grass springs up early in the season. It is at its best for providing pasture in all the Northern States early in June, and in those further to the southward in May. Then it remains dormant in summer and springs into life again in the autumn with the arrival of the autumnal rains. In Kentucky and other states in latitudes where the winters are mild, this grass furnishes much food at that season. The chief exception taken to blue grass in the Northwest is the long period during which it lies dormant in the summer. This can in part be remedied by refraining from pasturing too closely.

From what has been said, it will be apparent that this grass will grow in almost any kind of soil, that under reasonable conditions no difficulty will be found in sustaining it, and that once in the soil it is likely to spring up again after the land has been cultivated. Moreover, owing to the many root stocks which it produces, blue grass serves an excellent purpose in putting vegetable matter in the soil which will bring moisture to it when other crops have been made to follow it. Its appearance therefore should be countenanced by sowing it freely where it has not yet been grown.

Blue grass is grown more for pasture than for hay, and when grown alone it furnishes the most common form of permanent pasture found in America. It is seldom sown to produce hay. On old cultivated lands it will come into a permanent pasture composed of mixed grasses as it were spontaneously in two or three years, but its advent is hastened by sowing some of the seed when the permanent pasture is laid down.

The seed is commonly sown by hand and covered with the harrow. It may be put in with a nurse crop the same as other grasses. Two bushels of seed are recommended per acre when blue grass is the only grass sown. The seed weighs 14 lbs. per bushel. When this grass has once become established it will stand any amount of cropping. The cold of winter seems to have no power to kill it, and it seems virtually able to endure the most prolonged drought of summer.

Blue grass must be very promptly cut when it is to be cured for hay. If allowed to get too far advanced before it is cut it will be almost valueless for fodder, and the same is true when it is allowed to dry too much in the sun while being cured. Blue grass is ready for cutting when once fully out in head.

Orchard Grass.—Orchard grass (*Dactylis glomerata*), (see Fig. 1) is a perennial which grows vigorously on suitable soils. It is thought to be a native of Europe, but is now found in North Africa, India and North America. Noted for its persistent growth, it furnishes good pasture in the spring and also in the autumn, ordinarily growing from two to two and a half feet in height when matured. The leaves are numerous, large and somewhat coarse. The heads are branched rather than single.

This grass is possessed of wonderful adaptation to various soils and climates, and to different modes of treatment. As the name implies, it is well suited to shady places, such as orchards and groves, where the foliage is not too dense. It grows particularly well in the climate of New England. In some of the Central States it has also proved a decided success. But in the West the accounts regarding it are not quite so hopeful, and in the Northwest experience with reference to growing it is as yet comparatively limited. Some of those who have tried it are well pleased with the results. On the slopes of the Pacific, where the rainfall is abundant, orchard grass should do very well.

This grass is grown both as a pasture and for hay, but more especially to provide pasture. In congenial situations no other grass probably will equal it in furnishing pasture, in orchards and open groves, but it will not grow in a thicket or amid underwood. It is much given to growing in tufts, particularly as it becomes older. This may be partially prevented by sowing the seed thickly. When raised for hay under favorable conditions, more than one crop per year is sometimes obtained. And when but one crop is cut in the season the aftermath is usually luxuriant.

Orchard grass is more suitable for pasture than for meadow, for the reason, first, that the leaves are abundant in proportion to the stems; second, it commences to grow very early in the spring, fully two weeks sooner than almost any other variety of cultivated grass, and it continues to flourish where the moisture is sufficient until frosts come in the autumn; third, it is less affected by the drought of summer than many other varieties of grass, and fourth, where the conditions are favorable its durability is marked. This grass has been grown on the same land for from thirty to forty years.

Orchard grass is best adapted to good, strong, deep loam soils, free



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• FIG. 1. ORCHARD GRASS. •

in texture and fairly porous in character. The subsoil should be medium both as regards texture and moisture. It will not thrive on poor, light soils, on gravels or on lands naturally wet or undrained. It will grow fairly well on clays but not nearly so freely as on rich loams. The practice is more common of sowing orchard grass in the spring than at any other season, and where the winters are severe it cannot be sown later with safety, but in moist regions with mild winters it can be sown early in August. It may be seeded by itself or along with a crop of grain. When sown by itself the seed may be scattered broadcast or put in with the grain drill. If sown with the grain drill no further covering would be required, but when scattered broadcast it should be covered to a fair depth in prairie soils, and to a less depth in soils more stiff in texture. It has been claimed that as many as twenty-eight pounds of seed or two bushels per acre are necessary if orchard grass is grown by itself. When sown as a part of a mixture for meadow or for permanent pasture, only a few pounds of seed per acre are required. In a meadow this grass should accompany the common red clover, as they are ready for harvesting about the same time. But orchard grass is not very well suited for being grown in a meadow, owing to the tendency which it seems to possess to crowd out other grasses.

In localities where orchard grass will grow freely along with blue grass and white clover, the three make an excellent and durable permanent pasture. The quantity of seed to be sown would depend largely on the proportions of the other varieties wanted. But as both blue grass and white clover seem able eventually to occupy the ground to the virtual exclusion of the orchard grass a liberal seeding of the latter should be used.

When grown for hay, orchard grass should be cut when in early bloom. If allowed to pass this stage it soon becomes woody and unpalatable. It is easily cured, and care should be taken to rake it as soon as ready. When it gets too dry it becomes woody and is not relished by live stock. If a crop of seed is wanted, the plan is sometimes adopted of cutting the orchard grass with the binder. The machine is set to cut the grass high to avoid gathering the mass of foliage which covers the ground for some distance above the surface.

This grass is well worthy of a trial in the Northwest. But it should be sown here in small areas until more has been learned of its adaptability. Two methods of trying it may be outlined. First, it may be

sown thinly in groves free from underwood, in the very early spring, and second, it may be sown by itself at the same season, on a well prepared plot of ground somewhat limited in extent.

Meadow Fescue.—Meadow fescue (*Festuca pratensis*) is a perennial and like nearly all the members of the fescue family, it is hardy and well able to retain its hold upon the soil. Sometimes it is called Randall grass, and it is not infrequently mistaken for tall meadow fescue, to which it bears no little resemblance. It does not grow quite so tall as timothy, but it stools out well, and furnishes pasture or fodder fine in character, rather than coarse.

Although probably a native of Europe, this grass grows well in all the Middle States, and in those to the north so far as it has been tried, but its value for the Northwest has not yet been fully ascertained. In Ontario it grows very well, and also in the Province of Quebec.

Meadow fescue is a very hardy plant, a most persistent grower, produces a fair amount of aftermath and is long lived. Its long fibrous roots enable it to withstand drought well. Properly speaking it may be termed a midsummer grass, but it ripens quite as soon as timothy. It is much relished by live stock whether used as a pasture or as hay. Meadow fescue is very well suited to a wide range of soils, for instance loams, clays and gravels, not too open in texture. It is proving itself one of the best adapted to American conditions of any member of the fescue family, if not indeed the best. In strong, deep, low lying soils it grows very freely, but on average, arable, upland soils it also seems to do well.

It is not usual to grow this grass by itself unless to procure seed from it. It may be grown in meadows, but only in those which are to be cut for hay for a number of years successively, since it takes meadow fescue some considerable time to establish itself. It does not therefore reach the highest stage of growth until a year or more after it has been sown. If sown in meadows it should be grown along with timothy. This grass is useful in permanent pastures, and is more commonly grown in them than in any other way. The seed weighs 15 pounds per bushel and when sown to produce seed probably not less than 30 pounds or two bushels would be required per acre. In appearance the seed bears a close resemblance to that of perennial rye grass.

When permanent pastures are laid down in the Northwest, meadow fescue should be one of the grasses of which these should be composed.

Information is very scant with regard to the growth of tall oat grass in the Northwest. It could be more readily tried at first as the sole crop grown on the ground for the season. Good, clean, moist land should be chosen. It merits a careful trial at the hands of those interested.

Meadow Foxtail.—Meadow foxtail (*Alopecurus pratensis*) is a perennial of erect habit of growth. It reaches very nearly the ordinary height of timothy when fully matured. It also bears resemblance to timothy but has a smaller and softer head, is more leafy in character, and springs up quickly when pastured or mown. Although indigenous to Europe it is now found in North Africa, Western Asia and America.

This grass produces a large quantity of leafy herbage in proportion to the stalk, hence it is much relished by live stock. It is among the earliest of the cultivated grasses and ripens its seeds nearly if not quite a month earlier than timothy. Like orchard grass it will thrive well under trees and in shady places, but it will also grow when exposed under suitable conditions. It is said to be even more hardy than timothy.

Meadow foxtail is better adapted relatively for permanent pastures than for meadows. When sown in meadows, other grasses which mature more quickly are apt to crowd meadow foxtail which does not reach its best until three or four years after it has been sown. The seed is not produced so freely as that of some other kinds of grass, and in consequence less of it is sown than would be probably under other conditions.

Meadow foxtail is partial to deep, rich soils, but it also flourishes in moist climates on stiff loams and clays. It cannot live in a water-logged soil and yet it is well suited to land subject to irrigation. It is but ill-adapted to light, dry soils lacking in plant food and in power to retain moisture.

When meadow foxtail is sown alone from two to three bushels of seed would be necessary. The seed is sown in the chaff. It only weighs about five pounds per bushel. It is common to sow it by hand and to cover it with the harrow. When sown in permanent pastures it is mixed with the other coarse seeds and sown along with them.

Experience as regards the growing of this grass in the Northwest, is limited, hence but little can be said as to its adaptability. But we know in reference to it that it is hardy and that it grows early in the season, therefore it is worthy of a trial.

Red Top.—Red top (*Agrostis vulgaris*) is of many varieties. It is also known by other names more or less local in their application. This grass is found in one or the other of its many forms in nearly all parts of the continent capable of producing low land grasses. Although it is well adapted to the conditions in all states in which the climate is mild, as for instance Georgia and Tennessee, it also has an important mission before it in the Northwest, where it has given the most encouraging results.

Red top is of a somewhat slender habit of growth. It has rather fine foliage and throws out a slender open and spreading head. A red top meadow when matured or when it is approaching maturity. has a tinge that may be defined as reddish brown, hence probably the origin of the name. The root stocks push through the soil and form fresh plants so that when there is only a thin seeding of the plants at first, they soon spread and take possession of the soil, unless when growing along with some variety of grass that is peculiarly aggressive. This grass grows more slowly than some other grasses. It will furnish pasture or hay as may be desired. In feeding value it takes a place certainly not less than medium.

Red top thrives naturally on a moist soil, too moist for growing upland grasses upon it successfully. It will not grow well upon high, dry soils. This grass will usually grow however on lands that will produce timothy, but timothy may be destroyed by water on soils where red top will continue to live and flourish.

When sown alone it has been recommended that from two to three bushels of seed, that is to say twenty-four to thirty-six pounds should be used per acre. It may be sown by itself or with some nurse crop adapted to moist soils, such as barley for instance. It may frequently be sown with timothy, as they ripen about the same time. And it is often used in the mixture when permanent pastures are being laid down. Red top stands pasturing well, but runs out in a few years if allowed to ripen its seeds from year to year. It may be sown in sloughs and wet places not yet dry enough for the plow. In such places only a few pounds of seed per acre are needed and the seed should be sown as soon as the work can be easily done. When purchasing seed preference should be given to what is termed the "fancy or solid," that is to say, the clean seed rather than seed in the chaff as it is impossible to determine really the amount of pure seed which the latter contains.



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FIG. 2. AUSTRIAN BROME GRASS. (*Bromus Inermis*.)

Wild Timothy.—Wild timothy (*Muhlenbergia glomerata*) is also called drop seed grass. This grass which bears no little resemblance to timothy is indigenous to the Northwest. It is one of the limited number of the wild varieties of the region named, which gives promise of profitable returns from cultivation. The heads rather resemble those of orchard grass than timothy.

This grass has been very successfully grown for the past five years at the Experimental Farm at Brandon, Manitoba. During the past four years nearly two tons of hay per acre have been harvested each year. The manager of the farm, Mr. S. A. Bedford, speaks of it favorably. It makes good hay though its properties for pasture do not seem to have been determined as yet. This grass is adapted to average prairie soils, but it will not do so well on those dry and hungry. It yields seed freely. The seed weighs about twenty pounds per bushel, and from five to ten pounds of the seed are used per acre. But the heavier seedling is rather preferred.

In preparing the soil it has been customary to summer fallow it and then to sow the seed from August 1st to August 15th, when a crop of the grass may be obtained the following year. It may also be sown early in the spring along with a nurse crop thinly seeded. This grass should be tried in all parts of this country.

Austrian Brome Grass.—Austrian brome grass (*Bromus inermis*) (see Fig. 2) is a native of Europe, and one of the most promising cultivated grasses that has yet been tried on the prairies of the west. It is very hardy, enduring very low temperatures in winter, and possessing great power to grow in dry climates, under adverse conditions. It is well adapted to produce either hay or pasture. This grass comes up quickly in the spring and makes a rapid growth, and when it has been cut for hay the aftermath is also abundant unless the weather should be abnormally dry. It sends numerous root stocks through the soil to form fresh plants, hence it will probably require to be ploughed up after having been mowed or pastured for a limited term of years. The foliage is abundant on Austrian brome grass, and it produces seed profusely. Mr. A. MacKay, Superintendent of the Experimental Farm, at Indian Head, Assiniboia, obtained one hundred and fifty pounds of seed from one-fourth of an acre in 1893. The seed weighs 14 pounds per bushel. More than two tons per acre have been harvested during each of the past three years at the aforementioned farm.

Austrian brome grass seems well suited to the soils usually found on the prairie. In moist climates it may be too aggressive to grow with other grasses, and this property also may exclude it from permanent pastures. But for growing on dry soils it seems to have few equals. The ground is prepared for this grass in the same way as for wild timothy previously discussed. Fifteen pounds of seed per acre are sufficient. Austrian brome grass should be tried by every farmer in the Northwest. A plant with properties so valuable cannot be obtained too soon.

Clovers.

The clovers are of inestimable value to the agriculturist wherever they can be successfully grown. They furnish excellent pasture during a large portion of the year, and they yield, a healthful, nutritious and valuable fodder which may be advantageously fed to any class of live stock. The roots of the different varieties of clover go more or less deeply into the subsoil, whence they obtain moisture to sustain growth in dry weather. They also bring up plant food which may be utilized in growing crops unable to gather food from far below the surface of the soil. And when the roots decay they furnish channels through which the super-abundant moisture may escape downwards. The roots and rootlets bring much vegetable matter to the soil. These bind light lands together and thus make them less porous, and they render stiff clays more open and friable. All kinds of clover are peculiarly helpful not only in sustaining the fertility of the soil, but in still further increasing the same, owing to the wonderful power which they have of absorbing nitrogen from the air, and also to the great extent to which they store the same in the soil.

The most valuable varieties of clover as yet grown upon this continent include the common red, mammoth, alsike, lucerne, white, crimson and yellow varieties.

Common or Medium Clover.—The common red clover (*Trifolium pratense*) is so well known that a detailed description of it is not necessary. It is unquestionably one of the most useful plants ever given to mankind by a beneficent Creator. Ordinarily it yields two good crops of hay during the second season of its growth, or one crop of hay and one crop of seed, or one crop of hay followed by several months of pasturage. It will furnish pasture through the whole of the second season where the same may be required, but usually dies at the

end of the second year as it is a biennial, although sometimes under very favorable conditions it may live longer when not allowed to produce seed.

Clover will do well in almost any kind of soil, but better results relatively are obtained when it is grown on clay loams with a subsoil of clay not too dense. It will grow satisfactorily on stiff clays, but on these in dry seasons there is difficulty in getting a "catch" of the seed. In such seasons it will also pine and die on porous sands after the plants have made a start.

A bare fallow, a corn crop or a root crop make an excellent preparation for clover seed to be sown the following spring on spongy prairie soils, for then the land is clean, dense and better able to retain moisture. But in such instances it should not be ploughed in the spring.

Clover may be sown by the same methods as timothy, and the conditions which govern the amount of seed to be used are very similar. When grown by itself from eight to twelve pounds of seed per acre are commonly used, but if it is sown as a green manure even a larger quantity may be utilized with advantage. It may be sown alone, but more generally it is put into the soil along with some other kind of crop, such as wheat, rye, barley and oats. The object should be to sow it in the early spring and as soon as possible after the winter season is over. It should never be sown in the autumn in northern latitudes as it is then almost certain to be killed by the cold. When the ground is in a honey-combed state as is sometimes the case in the early spring or just after a light shower has fallen, the conditions for sowing clover are very favorable. In the Northwest the best results will probably be obtained from sowing the seed on a crop of rye as soon as the ground is dry enough in the spring, and then harrowing it with a light harrow. In moist climates and on spring sown cereals it will probably suffice to cover the seed with the roller, but in the Northwest it should ordinarily be covered by allowing the seed to fall before the drill tubes when sowing grain or by using a light harrow when the seed has been sown on the surface.

The common red clover is often grown for the seed, and it may be remarked in passing that Minnesota grown clover seed takes high rank in the various seed markets. When so grown it is common to cut the first crop for hay when it has reached early full bloom. The second crop is then cut for seed. Sometimes the clover is pastured until that

season arrives when, had it not been so pastured, the heads would form. The pasturing then ceases and a crop of seed is grown. By managing thus the clover midge may be baffled. The seed is ready for harvesting when two-thirds of the heads are ripe. A machine is used in cutting the crop which leaves the clover in bunches where it lies until ready for being stacked or threshed. From two to three bushels per acre is an average yield but sometimes much more than the quantity named is produced. The seed is threshed by a machine termed a "huller." Where such machines are not available the farmer can beat out the seed with a flail and sow in the chaff, but of course such seed would not be of any use for marketing.

The common red clover is now most successfully grown in many parts of the Northwest, where at one time it was supposed it could not be raised. It may be mentioned here without hazard and without pausing to give the reasons that clover will yet be grown with favorable results much further to the north and west than at present, and that it will be grown with increased success as the soil becomes older where a judicious system of farming is pursued. Drought at that season of the year when the young plants have not yet made much growth and while their tap roots have not yet gone down beyond the influences of surface evaporation is the great obstacle in the way of getting a good "stand" of clover, hence the importance of early sowing and of preparing the soil by previous cultivation to resist the influences of drought.

Mammoth Clover.—Mammoth clover (*Trifolium pratense* or *medium*) bears a somewhat close resemblance to the common red variety in the shape of the leaves and stalks, and in the shape and color of the head. It is of much stronger growth however than the latter, has a larger stem in proportion, grows considerably taller, possesses larger heads and furnishes a much greater quantity of fodder. This clover also ripens some two or three weeks later, and produces but little aftermath, whether it is grown for the seed or for hay. It also sends its roots down more deeply into the soil.

Mammoth clover is therefore more valuable than the common red variety, first, when used as a green manure, owing to the dense mass of vegetable matter which it furnishes both in the tops and in the roots; second, on prairie soils which do not produce a strong growth of the small variety, and third, on stiff clays which do not grow the mammoth variety so luxuriantly as to make the fodder coarse. It is less

valuable, first, in moist climates where the aftermath is needed for pasture; second, where both a crop of hay and a yield of seed are sought the same season, for the mammoth clover will only stand one cutting in the year, and third, on strong soils on which the large variety would grow too coarse to make good fodder.

Mammoth clover is therefore adapted to the same kinds of soil as the common red variety, with the difference that preference should be given to the large variety wherever the small kind is deficient in bulk of forage or fodder. It is also suited to the same climates and its place in the rotation is the same. The preparation of the ground is similar and the same modes of sowing may be adopted. The amounts of seed will also be nearly the same, but a little more of the mammoth variety may be used. Mammoth clover and timothy ripen about the same time, hence they may be profitably grown together for hay, when the clover is not so thick and strong as to overshadow the timothy.

When mammoth clover is grown for seed it should be sown alone; that is to say, no other kind of clover or grass should be sown along with it. It is ready for cutting when two-thirds of the heads are ripe. It is harvested and threshed in the same way as the small variety. In sections where the growth will probably be rank, it may be well to pasture the clover for two or three weeks in the early spring. Another plan would be to run the mower over it when it is a few inches high. The portion of the crop which is then cut will furnish a good mulch in dry weather. An average crop of seed is from two to three bushels per acre.

Alsike Clover.—Alsike clover (*Trifolium hybridum*) is of European origin. It is a perennial, and is one of the most hardy and vigorous of all the varieties of clover as yet introduced into America. It usually grows to the height of from twelve to eighteen inches, but in congenial soils and under favorable climatic conditions it attains a height considerably greater. It is fine in its habits of growth, and has a large proportion of leaves, hence its excellence as a food for live stock when used as fodder, more especially for sheep and lambs. The heads are numerous but small, and the blossoms are a beautiful delicate crimson.

Alsike clover is rapidly gaining in favor all over the northern half of this continent. It seems singularly well adapted to the conditions of



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FIG. 3. ALSIKE OR SWEDISH CLOVER.

growth in some of the New England States, in Ontario, Canada, and in some of the Provinces lying further to the east. But it will also grow in fine form in congenial situations westward from the States and Provinces named to the Pacific. Although very hardy it does not seem well able to withstand the winters of Manitoba and Assiniboia, but in all the Northern and Northwestern states of the Union, alsike clover will prove a valuable crop, and also in the adjoining states to the southward.

This clover prefers damp, moist, loam soils, but it will also grow fairly well in stiff clays. In the Northwestern States the best results are obtained from sowing alsike clover on damp, moist bottom lands, but in the states of the Union and in the Provinces of Canada lying to the east from Michigan, where the annual rainfall is greater, it will grow well on average arable soils, particularly on those underlaid with a moderately porous subsoil. When raised for the seed, the lower lands are not so suitable as those somewhat higher, as they produce an excess of growth in the stalk and leaf. This plant develops feebly on light, sandy and gravelly soils, so much so that it is unwise to grow it upon these.

The preparation of the soil for alsike clover is the same virtually as for common red clover. And the conditions which govern the sowing are also very similar. It may be sown with much advantage along with timothy, for making hay, for the reason first, that both of these crops are well adapted to moist soils, and second, that they also mature about the same time. If grown for seed it should be grown alone as it is impossible to separate alsike clover seed from timothy seed, they are so nearly alike in size.

The time for sowing this crop is the same as for common red clover, that is, the early spring. When grown for hay, along with timothy, about three pounds of the clover and six pounds of the timothy per acre will be found sufficient. If grown for the seed from five to six pounds may be named as an average quantity. The seed is sown with a nurse crop, and barley will probably be found the most suitable, as it is adapted to the same kinds of soil as the clover. The sowing of the seed may be done by hand, with a hand sower, or best of all with the grass seed sowing attachment to the grain drill. In the Northwest if the seed is allowed to fall before the grain tubes, it will be sufficiently covered, otherwise it would require a light covering with the harrow.

In states with a moist climate, rolling the ground after the seed is sown would provide a sufficient covering.

Alsike clover is ready to be cut for hay as soon as it is in full bloom. It can be cured more easily than other kinds of clover possessed of more stem. If harvested for seed the cutting should take place when two-thirds of the heads are ripe. The one-third of the heads unmaturing would not produce a large quantity relatively of seed, and if the cutting of the crop were to be delayed until the late heads were matured, the early or first ripe heads would break off before the crop was harvested.

When alsike clover is to be reaped for seed, it would repay the grower to go over the field and cut off the heads of all the weeds likely to mature before the reaping of the crop. The mode of reaping is the same as for a crop of red clover. As the heads of alsike clover break off very easily when ripe, much care should be exercised in handling it. Some farmers prefer to cut it only in the evening and on into the night when the moonlight is sufficient, and they also refrain from drawing and housing it during the hot portion of the day.

An average crop of alsike yields from two to four bushels of seed per acre, hence in localities well adapted to growing seed it is considered a good paying crop. Where it is only wanted for hay, timothy seed and alsike clover seed may be obtained from a crop of the two grown together, as they ripen at the same time, but it would not be readily saleable seed, as it would be mixed.

Alsike clover furnishes a good pasture until the season for harvesting. It does not grow much at any time subsequent to that period. The aftermath is of but little account for pasture. When grown along with timothy or other grasses for pasture it has much power to retain its hold upon the land, more especially if the pasturing has not been so close as to prevent it from maturing some seeds. It is also one of the best honey producing plants that can be grown.

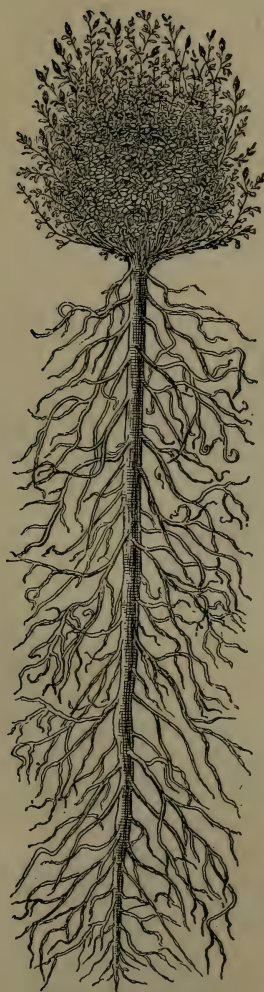
Owing to the many excellent qualities of alsike clover, to the varied uses to which it can be put, and to its marked adaptability to the Northwest, it should unquestionably be sown to a greater or lesser extent by all farmers whose soils are suitable.

Lucerne.—Lucerne (*Medicago sativa*) (see Fig. 4) is a plant which grows freely when once it has been established. It possesses the power of retaining its hold upon the land for several years. The roots

go down deeply in suitable soils, hence lucerne is better able to withstand the influences of dry weather than the other varieties of clover. Despite its vigor when established, it is a delicate plant when young, and therefore more liable to perish the first season than other kinds of clover. It is rather grown for soiling and fodder uses than for pasture, although under certain conditions it furnishes excellent pasture. Lucerne is better adapted to mild than to cold climates, hence it is extensively grown in southern Europe and the warmer and dryer portions of the United States westward from the Mississippi River. It will thrive fairly well in New England, in the Middle States and in Ontario, Canada, but in countries where red clover will grow rapidly the latter is commonly considered a more profitable plant than lucerne, as it is much better adapted to a short rotation. The precise value of lucerne in the Northwest has not yet been determined, but in some states, as for instance Montana, it grows well. This clover should be carefully tried in all parts of the Northwest where the soils are at all suitable, as, owing to its ability to grow in dry weather, it will prove valuable in the areas named wherever it can be grown. In some countries lucerne is more commonly known by the name of alfalfa.

Lucerne is admirably adapted for soiling uses, as it will furnish two cuttings a year, and in some instances as many as four. On irrigated soils even a larger number of crops have been obtained in one season. It does not stand close cropping so well as red clover. It is rich in protein and hence is excellent for producing milk and muscle if pastured or fed as hay. In countries where the climate is moist it may produce bloating when the live stock feed very freely upon it, particularly when it is damp. Because of this it may be well to wilt it somewhat before feeding it when it is to be used as a soiling food. Lucerne is also valuable as a source of fertility, since it has much power to absorb nitrogen from the air and from the subsoil.

Lucerne is best adapted to sandy and loam soils, with a deep, porous, calcareous subsoil, and in those parts of Minnesota where good results have not been obtained, it has probably been owing very largely to the lack of lime in the subsoil. When once established it will grow fairly well on clays, providing the subsoil is of the proper character. The nature of the surface soil is of less consequence than that of the subsoil, and yet lucerne will not grow well on some soils. It does not seem well suited to black loams, more especially those deficient in



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FIG 4. ALFALFA OR LUCERNE CLOVER.

clay. Nor can it be made to flourish under any condition when the subsoil holds water for a prolonged period at any season of the year.

This clover is sown early in the spring. It may be sown alone or along with another crop. The preparation of the soil for lucerne is much the same as for red clover. When it is sown alone the mower should be run over the ground once or more frequently in the season, to prevent weeds from maturing their seeds, but the mower knife should be made to cut as high as possible above the ground. The seed may be scattered by hand or with a hand machine. It should be carefully covered with the harrow, and somewhat deeply on prairie soils, but not to so great a depth on those more dense in character. When sown with a grain crop rye and barley have been found more suitable than other cereals. One bushel per acre of the nurse crop, that is, of the barley or of the rye, will suffice. The lucerne may be sown at the same time as the grain. If the seed can be made to fall before the grain tubes it will be sufficiently covered without being harrowed. From twelve to twenty pounds of seed are required per acre.

In some countries lucerne is sown in rows eight inches or more apart, and is hoed or cultivated from two to four or five times during the first season. When thus cultivated the plants make a strong growth the first season, hence they are better able to withstand the vicissitudes of adverse weather. This method will answer when only small quantities are desired, but for large areas it is impracticable where labor is costly. And it may be well to mention here that it would doubtless be a good plan to grow a small quantity of lucerne near the stable for soiling uses when it would not be wise to grow it as a principal crop.

Much care is necessary in harvesting lucerne. When allowed to pass the early stage of bloom before being cut it becomes woody, and in consequence its feeding value is much impaired. Care should be taken to put it up in cocks or coils as soon as it has become dry enough to be drawn together with the horse rake. When allowed to lie long on the ground, exposed to the influences of the hot sun, the leaves break off when it is being handled, hence the loss from this source is very extensive. In climates subject to unsteady weather in harvest time lucerne, like red clover, is very difficult to cure when showers fall frequently. The seed from lucerne is commonly taken from the second cutting for the season.

When a field of lucerne is to be ploughed the task may prove an arduous one if undertaken with the ordinary plough, owing to the difficulty of cutting off the strong roots of the lucerne. The process of ploughing will be much facilitated by having the plough-share laid with a plate of steel, the edges of which are serrated. This gives the share a cutting power which it does not ordinarily possess, and in consequence enables it to cut off the strong roots of the lucerne which would otherwise probably turn the plough out of its course.

White Clover.—White clover (*Trifolium repens*) is more generally distributed than any other variety. It is claimed that it is indigenous to both Europe and America. It is sometimes called Dutch clover, and will grow readily in all the northern areas of the United States where it has been tried, although it seems better adapted to those states with a fair amount of rainfall during the season of growth, and in which the soil possesses a goodly portion of the clay element.

White clover is the most aggressive of all the clovers. In regard to aggressiveness it bears about the same relation to the other varieties of clover as blue grass does to the other varieties of grass. It would seem to travel westward in the wake of colonization and settlement. It follows man with its beneficent mission, and when once established in the soil it springs up again, while at the same time it does not hinder cultivation or interfere in any adverse way with the rotation of crops.

This valuable little plant is of a low, spreading, recumbent habit of growth. It throws out tendrils which possess the power of becoming rooted at intervals in the soil, hence the explanation of the extent to which it covers the soil. The blossoms are pure white or tinged with crimson. The heads seldom reach the height of one foot above the surface of the ground. The blossoms appear in June in the Northern states, and where the climate is moist the season of bloom is prolonged.

White clover is seldom sown for hay, although when it is desirable to have hay of a fine quality, to feed sheep for instance, it may be profitable to sow it as one part of a mixture. It grows singularly well along with blue grass, hence wherever a blue grass pasture has become well established, in time we find white clover growing along with it. Wherever the two grow together the one seems to aid rather than to retard the growth of the other. The blue grass furnishes a

grateful shade to the clover, favorable to its development, and the clover in turn feeds the blue grass; as, being a *legume*, it has the power of absorbing nitrogen from the atmosphere. Like blue grass it will come into a permanent pasture as it were spontaneously, on all soils where it grew previously. But when these lands are laid down to permanent pasture, it will hasten the advent of the clover if some of the seed be sown along with the other grasses of the mixture,

Although white clover will grow on a great variety of soils, it is better adapted to those which are moist and which are not too light in texture. On loam soils it grows much more luxuriantly than on gravels, for instance. It is not so well suited to the humus soils of the prairie as to those of firmer texture, yet it will do fairly well on these. Its growth should be everywhere encouraged in the prairies, since it brings fertility to the land, furnishes valuable pasture, and also adds to the moisture of the soil.

In preparing the soil for white clover fine pulverization is essential, as the seed of this plant is very small and the growth of the plant is delicate at first. The soil should also be in a clean condition, lest weeds injure the clover by their growth while it is still young. The seed may be sown in a manner similar to that of other clover seeds. When sown alone from three to four pounds of seed will be found ample for one acre. If sown along with a nurse crop the latter should be thin rather than dense.

White clover should be encouraged to grow over all the Northwest. The seed should be strewn over waste places and in all parts where the land is not soon to be cultivated, unless where the shade or the excess of moisture are likely to retard successful growth. Why not have a good thing speedily, when we can obtain it by putting forth an effort, rather than wait long years for its arrival? It is one of the best plants for yielding honey in America.

Crimson Clover.—Crimson clover (*Trifolium incarnatum*) (see Fig. 5) is a native of Central and Southern Europe. It has not been extensively grown in America until within a comparatively recent period. There are at least five varieties, of which four have scarlet blossoms and the fifth a white one. It grows from one to two feet high, has strong upright stems, and large, cone shaped heads of a beautiful crimson hue. The roots go down deeply into the soil, hence this plant has been found of much value in fertilizing light and worn lands.



FIG. 5. SCARLET OR CRIMSON CLOVER.

Crimson clover is better adapted to mild latitudes than to those in which the climate is severe. It is an annual, making the principal portion of its growth in the autumn and in the spring. It finds much favor in the middle and lower Atlantic states, and in those bordering on the Gulf of Mexico. In the Central states the yields are not quite so satisfactory. In the states which border on the Mississippi from Minnesota southward, this clover should prove valuable. In the New England, Northern and Northwestern states, it seems to be too delicate to endure the severity of the winter. But it will probably be found that when sown in the early spring it will give a good yield of hay the same season on rich, damp soils, and in many sections of the localities named. And to ascertain if such be the case, it is well worthy of extended trial.

Crimson clover is best adapted to light, warm, free-working soils, but it will grow on any kind of soil open in texture and yet not so light as to be unable to retain moisture well. It is not well suited to stiff, cold clays, as in these it grows too slowly. In the light fruit lands of the middle and lower



FIG. 6. HEAD OF CRIMSON CLOVER. NATURAL SIZE.

Atlantic States, it has rendered excellent service, not only in producing fodder but also in furnishing a cheap means of renovating these.

The preparation of the soil for this crop involves clean tillage, and a fine seed bed. When wanted for pasture, soiling, hay or green manuring in the early part of the season, it would need to be sown from July to September, according to the locality and conditions. It is a common practice to sow it

in the standing corn at the time when the last cultivation is given the corn. But it can be sown alone very well on land from which some crop has been reaped after the same has been ploughed. It does not answer well to sow with winter rye as a nurse crop, for the clover grows so vigorously that it hinders the growth of the rye. When sown in the spring to be cut the same season, it would need to be put into the ground early, and it would also require to occupy the ground

alone. The mode of sowing would be the same as with common red clover.

Crimson clover sown in the summer and autumn months is ready for harvesting toward the close of the spring or the advent of summer. It is cut for hay at the same stage as common red clover. Difficulty is sometimes found in harvesting the crop at the season named.

Good crops of crimson clover produce large yields of seed, but the harvesting of the same requires prompt attention as soon as the crop is



FIG. 7. CRIMSON CLOVER LEAF, NATURAL SIZE.

ripe, owing to the ease with which the matured seeds are shed. The heads are large, hence when soaked with rain, they dry out so slowly that trouble frequently arises from the sprouting of the seed.

Where crimson clover will stand the winter well it will be found specially useful for the following purposes: First, it will provide pasture and excellent soiling food early in the season. Second, it will pro-

duce green manures to be plowed under in time to grow another crop the same season. Third it may be used in renovating orchards with but little outlay and in furnishing a soft, clean bed in them on which fruit may fall. And fourth, it will in a degree bind drift soils and prevent washing on hill sides.

Yellow Clover.—Yellow clover (*Medicago lupulina*) sometimes called trefoil, is a somewhat diminutive variety, of a creeping or recumbent rather than an upright habit of growth. It is of European origin but in some parts of this continent it seems to grow admirably. In England it grows so freely on some limestone soils that it is troublesome to the crops which come later. In the United States it will grow vigorously on the soils of New England and of some states further to the west, and in Ontario, Canada, it also seems to be at home. But in the Central and Northwestern States it appears to have received very little attention, more particularly in the latter where experience in growing it would seem to be almost entirely lacking.

Yellow clover begins to grow quite early in the season. In the Northern states it blooms in June, and matures its seeds about the end of that month, although where pastured closely it continues to produce new flowers for a period considerably later. It has a pretty yellow blossom, from which the name was doubtless derived.

Although yellow clover may be grown in a meadow, it is not well adapted for being thus grown, as other grasses crowd and shade it too much. But when sown as part of a mixture to form a permanent pasture, it seems to possess much power of retaining its hold upon the soil. It produces fine food for sheep and other kinds of live stock, but does not grow so well late in the season as white clover. It yields seed abundantly, hence when it once gets into the soil it will afterwards spring up in a pasture of its own accord.

As already intimated, yellow clover will grow vigorously in limestone soils. It is not well adapted to light soils. Like other varieties of clover it seems to make good use of the potash brought to it in the clay found in many loams. Nor is it well suited to low and very moist soils, such as favor the growth of alsike clover.

Yellow clover may be sown the same as other varieties. When sown alone from four to six pounds of seed per acre would be required. A nurse crop would also be in order for this plant. When sown along with other grasses for meadow which is afterwards to be turned into a

pasture, it will not be necessary to use more than two pounds of seed, and even a less quantity may suffice. This clover should be given a trial in the Northwest. The seed is not costly and it belongs to a family of plants of good reputation, hence it may be found of considerable value to the agriculture of the area named.



CHAPTER III.

PERMANENT PASTURES.

Permanent pastures are those which occupy the same soils for a long term of years to the exclusion of all other crops. They may include but one variety of grass or they may be composed of a number of varieties. Many of the pastures of the east for instance, contain blue grass only and it would not be incorrect to designate the unbroken prairie a permanent pasture so long as it remains unbroken. But the term permanent pasture as it is ordinarily understood, may be defined as a pasture comprising a number of grasses, native and foreign, which have been sown together on a piece of land that is to be pastured for a term of years.

Permanent pastures are more valuable relatively in countries of mild temperatures and moist climates. Where the winters are severe only the hardier varieties can be grown. A large number of varieties therefore, some of which are possessed of great feeding value cannot be grown in these localities. In regions of dry summers, some useful grasses do not make any growth, during the hot and dry portion of the season, and other kinds make but a feeble growth. No variety has yet been discovered which will grow so successfully as when there is an abundant rainfall in the summer. And if in addition to dry, hot weather during a considerable portion of the summer, the whole season of growth is short rather than long, the relative value of permanent pastures is still further lessened.

It follows therefore, first, that permanent pastures will not be so easily maintained, nor will they be so valuable relatively on this continent, as in Great Britain for instance, where the summers are moist and where there is a long season of growth. Second, that they will be less easily obtained and of less feeding value in the Northwest than in

New England, for example, with its moister climate. And third, that the slopes of the Pacific where moisture abounds should provide a very suitable home for permanent pastures. The absence of these however in the Northwest is amply compensated for by the ease with which forage and fodder crops may be grown.

But it would be a mistake to conclude that there is not a very important place for permanent pastures in this western country. That they may be grown in form very much superior to the grasses of the native prairie should not for a moment be questioned. Although it would be somewhat hazardous in the present state of our knowledge to name with absolute certainty the varieties of which they shall be composed, experience has demonstrated that certain grasses and clovers may be successfully raised, when grown singly, and from what is known concerning the habits of growth common to these it would be safe to assume that they can also be grown with favorable results in combination.

Those grasses and clovers which should certainly grow well in combination in the Northwest under almost any conditions include blue grass, white Dutch or common white clover and timothy. Those which may be relied upon to grow with much certainty in favorable localities comprise common red clover, mammoth clover, alsike clover, red top, Austrian brome grass (*Bromus inermis*), and wild timothy (*Muhlenbergia*). The varieties which may be expected to grow with a fair measure of certainty under favorable conditions include lucerne, orchard grass, tall oat grass, meadow fescue and meadow foxtail. And those found not well adapted to permanent pastures will probably embrace nearly all of the fescues and rye grasses. It may, however, be found profitable in some instances to sow some of the rye grasses for the crop they will bring the same season that they are sown. The rye grasses do not as a rule endure the cold of the winters in this latitude, and the fescues grow too slowly, though some native variety or varieties of fescue may yet be found serviceable. As common red clover and mammoth clover are biennials it is not usual to sow them in large quantities in a permanent pasture, since at the end of two years they will in a great measure disappear.

Laying Down Permanent Pastures.—In laying down permanent pastures the adaptation of the grasses to the soils is very important. A permanent pasture of blue grass and white clover may be made

on almost any kind of soil. Such a pasture especially on upland soils is much superior to the native prairie. Arable lands are usually considered too valuable to be thus used. The aim is rather to transform rugged lands into pastures of this nature. Such a transformation may be made by sowing the seed on these early in the spring just after the frost has left the ground, but a short distance below the surface. A few pounds only per acre of the seed will be required, but more of the blue grass will be needed than of the clover. A stroke or two of the harrow at such a time would cover the seed, but on rugged soils this may not be practicable. If the live stock of the farm were allowed to tread upon it some of the seed would be buried. On stiff soils such a course would seriously injure the land by poaching or trampling and thus impacting it. These pastures should not be eaten too closely the first and second seasons after the tame grasses have been sown in them to give opportunity for some of the seeds of the latter to mature for further reproduction. When these rugged lands are low-lying alsike clover and red top may also be sown. It is not necessary to sow more than a few pounds of the entire mixture. It would be quite impossible to name quantities that would be equally applicable to all conditions. In seeding down such lands the object should be to get the grasses started on a limited scale at first and then to give them a chance to increase, by allowing some of the seed to mature as intimated above, rather than to transform the pasture quickly by sowing large quantities of seed. As the seed when thus sown may possibly fail to grow, this plan would diminish the risk arising from sowing it in a wholesale way. If the season should prove more than ordinarily dry failure would ensue. But in such instances the husbandman should not be discouraged in repeating the process, for pastures thus transformed are certainly more valuable than those of the unmolested upland prairie. In moist regions excellent permanent pastures may be made by sowing blue grass and orchard grass in shady places, as for instance groves in which underwood is absent and in which the shade is not too dense. In the drier park regions of the west, blue grass may also be sown thus and possibly orchard grass as well, but as stated in Chapter II, the value of orchard grass in such places has yet to be proved. These grasses would require to be sown in the very early spring and where they can be harrowed the results will be much more satisfactory.

Pastures of more or less permanency may be established on arable lands in the Northwest, by using a limited number of grasses. These lands should possess at least a fair amount of moisture. The grasses may include such varieties as blue grass, timothy, common red or mammoth clover, alsike clover, white or Dutch clover, lucerne, and yellow clover. The following quantities of seed can be used, but there may be good reasons for varying these in certain instances:

| | |
|--------------------|-----------|
| Blue Grass..... | 3 pounds. |
| Timothy..... | 4 pounds. |
| Red Clover..... | 2 pounds. |
| Alsike Clover..... | 3 pounds. |
| Lucerne..... | 2 pounds. |
| White Clover..... | 2 pounds. |
| Yellow Clover..... | 1 pound. |

Total, 17 pounds.

Such a pasture may be used for a limited term of years, after which the land may be again made to form a part of the regular rotation. In preparing the soil thorough and careful cultivation will be necessary. The seeds will of course be sown along with some kind of grain crop and covered with the harrow. They should, whenever practicable, be sown upon land ploughed the previous autumn.

A permanent pasture with a yet more limited number of varieties can be laid down on lands that are quite low and moist. The varieties used with the respective amounts of seed per acre are the following:

| | |
|--------------------|-----------|
| Timothy..... | 6 pounds. |
| Blue Grass..... | 3 pounds. |
| Alsike Clover..... | 4 pounds. |
| White Clover..... | 1 pound. |

Total, 14 pounds.

In preparing the land for these grasses when the soil is spongy and possesses an excess of vegetable matter, it may be necessary first to grow upon it for a year or two such nitrogen consuming crops as flax. The seed may be best sown with a crop of barley, as barley will grow well on such soils.

But permanent pastures may also be laid down upon the European plan, namely the plan which includes a large number of varieties of grasses and clovers, intended to be kept as pastures for a long time.

When these pastures are thus laid down in America, whether in the west or in the east, good, rich, moist soils should be chosen. They should rest on a clay subsoil of only moderate texture, that is to say neither too porous nor too retentive. If the subsoil were too open the pastures would suffer in consequence in dry weather. If it were too close or too retentive they would suffer overmuch in wet weather. In the latter instance the soil would require to be thoroughly underdrained before it was laid down to permanent pasture. Sharp, sandy and gravelly soils are not suitable to the maintenance of permanent pastures. They are so deficient in moisture that they do not sustain a vigorous growth of grasses except for a short season in the early spring.

When lands are to be laid down to permanent pasture, it is greatly important that they should be entirely freed from noxious weed growth, so far as this can be accomplished without excessive labor. These pastures should then follow the bare fallow, or should come after a hoed or cultivated crop. A crop of mangels, turnips or beans would be more suitable to precede permanent pastures than corn, as the roots of the corn would be seriously in the way of the cultivation when preparing the ground for the seeds.

It is important that such lands should contain an abundance of plant food in order that the grasses may be well sustained the first season. When they enter the first winter in a vigorous and well-rooted state they do not readily succumb to vicissitudes of weather. If the lands are not rich they should be made so, either by applying farm-yard manure or artificial fertilizers. When the former is applied it should be put on in the autumn or winter preceding the sowing of the grasses and incorporated with the surface soil before the seed is sown. But when thus applied the manure would require to be well decomposed. If applied fresh it would be good policy to put it on freely when preparing the ground for the preceding crop. The residuum of it then left in the soil will be in a fine condition for sustaining a quick growth. When artificial fertilizers are used they may be applied in the spring while the land is being prepared for the grass seeds. A mixed fertilizer would be suitable, that is one possessed of nitrogen, phosphoric acid and potash. The object should be to so apply the fertilizer that it would be incorporated with the surface soil, and yet not be far from the surface. The nitrogeous portion when applied by itself would be better strewn upon the surface just after the plants appear above the ground.

When permanent pastures come after field roots the ground does not require any cultivation after the roots have been removed, further than that necessary to secure a fine surface pulverization the following spring. It will only be needful therefore to cultivate it as soon as the ground is dry in the spring, and to follow the cultivation with the harrow. In some instances it may be necessary to use the harrow only, more especially in soils a little spongy in texture. Ploughing the land in the spring would do harm, in bringing up weed seeds from the lower section of the soil which would prove troublesome afterwards, and it would so loosen the soil that the growth of the grasses would be injuriously affected, if a dry season were to follow. But the pulverization of the soil must be fine, for unless there is a minute division in the particles of the surface soil the quick growth of the young plants will be seriously retarded, more particularly those which possess least vigor when they first spring into life.

The varieties which compose the mixtures of grasses suitable for permanent pastures in the Northwest, will differ somewhat from those suitable for the same in countries to the eastward. It will therefore be necessary to mention in separate lists the grasses which may compose the mixtures to be sown in the Northwest and also those which may compose the mixtures to be sown in the East.

In the Northwest the following varieties, with the respective quantities mentioned of each, will be found suitable for sowing per acre:

| | |
|---------------------|-----------|
| Timothy..... | 4 pounds. |
| Blue Grass..... | 3 pounds. |
| Red Top..... | 2 pounds. |
| Orchard Grass..... | 2 pounds. |
| Meadow Fescue..... | 1 pound. |
| Tall Oat Grass..... | 1 pound. |
| Meadow Foxtail..... | 1 pound. |
| Alsike Clover..... | 3 pounds. |
| White Clover..... | 2 pounds. |
| Lucerne..... | 2 pounds. |
| Yellow Clover..... | 1 pound. |

Total, 22 pounds.

When the grower does not wish to hazard the kinds that are in a sense untried, as for instance, orchard grass, meadow fescue, tall oat

grass and meadow foxtail, these may be omitted from the mixture, and the quantities of timothy, blue grass, red top and alsike clover increased.

For states to the eastward of Michigan and for the Provinces of Canada eastward of Lake Huron the mixture may with advantage include the varieties named in the list submitted below, which also contains the respective amounts of seed required per acre:

| | |
|---------------------|-----------|
| Orchard Grass..... | 4 pounds. |
| Meadow Fescue..... | 3 pounds. |
| Tall Oat Grass..... | 2 pounds. |
| Timothy..... | 2 pounds. |
| Meadow Foxtail..... | 2 pounds. |
| Lucerne..... | 5 pounds. |
| Alsike Clover..... | 3 pounds. |
| White Clover..... | 2 pounds. |
| Yellow Clover..... | 1 pound. |

Total, 24 pounds.

These quantities are submitted as approximately suitable for average conditions. But it may be advantageous to vary them on soils which differ in quality. For instance, on those with a very moist sub-soil, lucerne would have to be omitted altogether. The omission would then be made good by a corresponding relative increase in the quantities of alsike and white clover.

The seed should be sown in the early spring as soon as the ground is dry. if sown later there is great danger that the young plants will perish when the warm, dry weather of summer sets in. It may be sown alone or with a nurse crop. The value of a nurse crop consists in providing shade for the young plants and in some instances in yielding some return for the ground that same season. Barley and spring rye would probably prove more suitable as nurse crops than other cereals, as the shade which they provide is less dense, and consequently more favorable to the growth of the young grasses. If nurse crops are used one bushel of seed per acre will be found ample.

When the grass seeds are sown alone they may be all mixed together and then scattered broadcast over the ground. Care should be taken to stir the mixture occasionally, lest the small seeds fall to the bottom of the sowing box and be scattered unequally. Another way

would be to sow the smaller and finer seeds after they had been mixed, with some kind of hand machine, and then to mix the larger varieties and sow them also. When the seeds are sown with a nurse crop, the latter may be sown with a grain drill and the smaller seeds can be mixed and sown at the same time when the drill has an attachment for sowing grass seeds. These small seeds should fall behind the drill tubes rather than in front of them. The larger seeds which the attachment may not be able to sow could then be mixed and sown by hand. Another plan would be to sow the small seeds with the seeder attachment to the grain drill, and then to mix the larger ones with the nurse crop and sow them along with the latter. But this method of sowing the larger grass seeds would not answer so well for the stiffer soils of the east as it would bury the seeds too deeply.

On the soils of the Northwest the seeds would require to be covered with the harrow. A smoothing harrow or one with many short teeth would well serve the purpose. On the soils of the eastern states and the eastern Provinces of Canada the seed should also get a slight covering with the harrow, but in some instances they would be sufficiently covered by running the roller over the field before rain fell in any considerable quantity. When the roller is thus used the covering will be more complete if it is driven across rather than along the drill marks.

If the grasses are sown alone, the mower may require to be run over the field once or twice during the season, to prevent the weeds which may have come up in the grass from seeding. When sown with a nurse crop the grain also should be reaped high rather than low. They should not be pastured the same season in which they are sown as pasturing would tend to pull out some of the feeble plants and to destroy others by trampling them. And it would render them less able to pass through the winter safely.

The management of permanent pastures after they have become established, is not difficult. It includes the prevention of weeds from maturing their seeds, an occasional harrowing, and it may also include renovating them. Weed seeds may be prevented from ripening by running the mower over the pastures once a year or oftener, but usually once a year will be sufficient. A thorough harrowing once or twice a year, more especially in conjunction with the application of fertilizers has a beneficial influence upon them. It would need to be given in the autumn or the early spring. But the question of renovating permanent pastures will be further discussed under a separate heading.

The Renovation of Permanent Pastures.—The renovation of permanent pastures may be of two kinds. First, it may relate to the fostering of a more abundant growth of the grasses which compose them. Or second, it may refer to the re-introduction of some varieties, which, from some cause or causes have partially or wholly disappeared from them. Experience in the renovation of permanent pastures even in the Atlantic States is limited and it is still more rare to the westward. As permanent pastures in this country, of what may be termed artificial origin, are as yet few and far between, experience in renovating them in any sense is almost entirely lacking. What is said on this question therefore may seem somewhat problematical but it will only be so, in so far as the statements based on general principles may lack support, when applied to specific instances from local causes which can only be brought to light by experience.

A more vigorous growth in permanent pastures may be secured in any country by any one of the following methods or by all of them combined:

First, it can be secured by what may be termed light pasturing. And the drier the climate the more important is it that the pasturing shall not be severe. The portions of a pasture not eaten closely act as a mulch for the grass roots to shield them from the evaporating influences of the sun and passing winds. Much more moisture is thus retained in the soil, and in consequence the growth of the grass is a great deal more vigorous than it would otherwise be. A covering of uneaten grass in autumn shelters the roots from the frosts of winter. Where such protection exists there is always an earlier and a more rapid growth of grass in the spring than where it is lacking. And the same is true in summer when rain moistens the ground which has been parched. There is also more vigor in the plant and therefore greater power to grow, let it be grass or grain which is not deprived of its leaves during the period of active growth. It is a mistake therefore under any condition to crop grasses off quite down to the ground, when there is any way of preventing this. Herein lies one reason for the great necessity of growing soiling crops to supplement the pastures.

Second, it may be secured by top dressing with farm-yard manures. These in addition to the fertility which they bring to pastures, act as a mulch and the benefit thus derived is probably as great in some instances as that arising from the enrichment of the land. When the

manures are spread over the pastures while fresh, greater benefits will result than if they are applied at a later stage. Farm-yard manures may be applied to grass lands at any season, but not with equal advantage. If put on when the pastures are fresh the taint from the manure will render the grass distasteful for a time. If applied when the weather is dry the benefits by way of enrichment are not at once bestowed. There is probably no season of the year at which manures may be utilized with so much advantage to grass lands as in the winter and more particularly the early winter, for when applied early they act as a mulch in protecting the grass from frost. But they may be spread over the ground with benefit any time during the winter even when the snow is deep. When the snows melt and the spring rains fall, the soluble parts of the manure are washed into the ground and at once start a vigorous growth, while the bulky portions act as a mulch. An extraordinary growth of grass may thus be secured early in the season. In no other way probably can farm-yard manures be utilized to better advantage than in the top dressing of pastures in the manner indicated. When the conditions of the pasture in many sections of the Northwest is taken into consideration, and when in those sections manure is burned or carted away into ravines language cannot well express the regret felt by those who know its value, in consequence of the loss involved.

Third, it may be secured by the application of artificial fertilizers. In the states to the eastward these will be required more than in the richer prairie lands of the west, and in the former better results relatively may be expected from their application, owing to the greater moisture which they possess. These fertilizers will be variously compounded with reference to the end in view. Nitrogenous fertilizers, for instance tankage, tend more especially to push forward grasses. Phosphatic fertilizers tend more equally to foster the growth of grasses and clovers, and potassic fertilizers have a tendency to promote the growth of the clovers, while wood ashes seem to form an especial food for white clover. These fertilizers may be applied in the autumn or the spring, except those that are nitrogenous which should only be utilized in the spring, as if applied in the autumn they might leech away before they are taken up by the plants. When phosphoric or potassic fertilizers are used the ground should be carefully harrowed after they have been sown. The harrowing incorporates them in the surface soil where they

at once begin to do their work, and it is also beneficial to the grasses. Nitrogenous fertilizers may be left on the surface except where it is more convenient to sow them in the spring as a part of the fertilizer mixture.

And fourth, it may be secured with some kinds of grasses by ploughing the ground and then harrowing it. Pastures composed of blue grass or blue grass and white clover may be renovated thus. The ploughing should be done in the autumn when the ground is moist, as the grass will then begin to grow at once in the early spring. The furrows should be turned at as great an angle as possible and the harrow should follow closely after the plough. The cultivation tears asunder the matted grass roots and loosens the soil so that a more vigorous growth is thereby ensured during the years immediately following.

The re-introduction into permanent pastures of varieties of grasses and clovers is less difficult in moist than in dry climates. It cannot be easily done except when the surface soil is torn up more or less by some implement of tillage, for instance the harrow. The seeds of the variety or varieties to be re-introduced should be sown before the ground is harrowed.

The duration of permanent pastures is dependent in a greater or less degree upon climate, soil, the closeness of the pasturing or the opposite, and the extent to which renovation is attempted. Moistness of climate lengthens their duration as does also richness of soil. Severe pasturing tends to shorten the period of their duration. But none of these influences affects their continuity so much as the adoption of judicious measures for renovating them. Permanent pastures on the European plan are not likely to maintain themselves for so long a period in the Northwest as in locations where moisture is more abundant.



CHAPTER IV.

FORAGE CROPS.

No one crop probably, can be found equal to common red clover as an all round forage crop. After clover, it would perhaps not be incorrect to name blue grass. But neither of these is a forage crop in the sense in which the term is used in this chapter. All grasses are, strictly speaking, forage crops. But these will not be considered, since the object aimed at is to treat only of such forage crops as are sown for the express purpose of furnishing food at a season of the year when succulent grasses are not abundant.

As forage crops are not often needed while succulent grasses abound, unless where a more or less complete system of soiling is followed, there is usually no demand for them before the first of July, and in moist seasons they may not be required until a period considerably later. The one exception is the early spring when the grasses are just beginning to waken into life, and the only forage crop that can render service at such a time is winter rye.

Winter Rye.—Both winter and summer rye are frequently sown as forage crops, but the former is decidedly the superior of the two for the use indicated, in all sections of the Northwest, and in all the northern portions of the United States. It is superior for the reason first, that it may be sown in the autumn when the press of farm work is not so great; second, that in moist seasons it will furnish pasture in both autumn and spring and also a crop of grain when such a crop is wanted; and third, it may be followed by another crop the same season after it has been pastured both in the autumn and in the spring. When a cultivated crop comes after a crop of rye, there is but little chance for weed life to make any headway or indeed to survive. Summer rye can only be made to produce forage at a time when some other foods may be better utilized for the same purpose.

Winter rye may be made to furnish excellent pasture for sheep and lambs both in the autumn and in the spring, but especially in the early spring. At that season it grows more rapidly than grass, and consequently furnishes forage somewhat earlier. And when rye is then accessible for pasturage, the stock may be kept off the grass pastures until the latter have made a good start. When sheep are pastured upon it in the spring, it may be found profitable to divide the field into two or three sections and to pasture the sheep successively on each in a regular alternation. The rye is then given a chance to grow up fresh and tender during the cessations of the periods of pasturage. It will furnish an excellent pasture for milch cows and other cattle, more particularly in the spring. But if pastured by this class of stock, it is more advantageous to have a grass pasture as well, upon which the cattle may graze in periods alternating with those during which they are allowed to graze upon the rye.



AMBER WINTER RYE.

This crop will also furnish a most excellent pasture for swine, both in autumn and spring, but more especially in the spring. Care should be taken not to crop the rye too closely in the autumn, lest it be injured by the severity of the winter following. When rye is being pastured, it should not be allowed to grow tall before it is eaten, or it will not be relished by the stock.

In case a crop of matured grain is wanted the pasturing must not continue too long. The time at which it should cease will vary with climate, locality and soil, but in the Northwest it should seldom be continued longer than the middle of May, and on light and poor soils it should cease at a period considerably earlier. Some of the crops that may follow rye during the same season in which it has been pastured, are as follows—corn, sorghum, rape, mangels and turnips.

Rye as a forage crop may be grown on almost

any kind of soil. It will grow in magnificent condition as a pasture on soil so rich that it would not mature in best form a good crop of grain. But it is more common to sow it upon poor soils for forage, since when pastured, it tends to improve rather than to impoverish them. Rye is peculiarly *the* grain crop for light, sandy soils, as it has much power to search for and take up plant food from the earth. The varieties of winter rye are not so numerous as those of the other cereals. The newer kinds have not yet been able to drive the old and well tried ones out of the field.

The ground may be prepared for rye by simply plowing after some grain crop has been removed from it. In the east it may be plowed deeply with advantage, but in the west and more especially in prairie soils, it should be plowed lightly, because of different soil and climatic conditions.

The time for sowing will depend to a considerable extent on the moisture in the soil. While it is well to have the ground ready as soon as possible after the harvest season, it will not avail to sow the rye so long as there is not enough moisture in the soil to cause germination. The lack of moisture would probably cause the seed to spoil, at least in some instances. After the land has been made ready the rye cannot be sown too early when there is sufficient moisture in the soil to germinate the seed. It must be kept from jointing the same season, however, by pasturing it when necessary, or it would be useless for any purpose the following spring. Rye should not be sown so late that the plants have not time to get a firm hold on the soil, or the winter may kill them.

The seed should be liberally applied. While one and one-half bushels per acre sown with the drill may be an abundant seeding for a grain crop, two and one-half bushels will not be excessive when sown as a forage crop. The reasons are so apparent as to render explanation unnecessary. The seed should be sown with the grain drill when practicable.

There does not seem to be any good reason why rye should not be sown to a greater or less extent on every farm in the Northwest on which live stock is numerously kept. It will doubtless come into great favor as a forage crop in the near future.

Nearly all winter rye shows, when harvested, quite a percentage of withered or shrunken kernels, causing considerable loss when

milled or marketed. The Northrup, Braslan, Goodwin Co. have lately introduced a variety called the "Amber Winter Rye" which seems to be almost entirely free from this objection, the grain being uniformly sound and handsome.

Rape.—Rape is one of the most useful forage plants that can be grown. As it is comparatively a new plant in nearly all sections of the United States, a description of it may be necessary. In appearance it resembles closely the Swedish or rutabaga varieties of the turnip. But this resemblance applies only to the tops. The roots are fusiform and without bulbs. They are numerous, ramify in all directions, and go down deeply into the soil in search of food. On rich soils and in favorable seasons, the tops reach the height of from two and a half to three feet, and they form a solid mass as it were of foliage from side to side of the field, but more commonly the plants do not grow higher than one and a half feet. Some varieties rather resemble fall than Swedish turnips, but these are not as yet in favor with growers in this country.

Rape is better adapted to moist than to dry climates, and to those of moderate rather than warm temperature. It is particularly well adapted to the climate of the New England states and Canada from Lake Huron eastward, but is scarcely so well adapted to that of the west and Northwest, although magnificent crops can be grown in these states under certain conditions. It will probably be less well adapted to the states further to the south, although there does not seem to be any good reason why rape should not furnish excellent forage for winter use in mild latitudes to the southward. It seems to produce excellent results in the moist latitudes between the Rocky Mountains and the Pacific. Outside of Canada, experience in growing rape on this continent is not extensive, but there is good reason to expect that hundreds of thousands of acres of this plant will be grown in the Northern states of the Union in the near future.

Rape furnishes fine forage for sheep and lambs, and in great abundance when a good "stand" is obtained. A good, medium crop should yield from 10 to 12 tons per acre. And its fattening properties are probably twice as good as those of clover. The sheep may be turned in upon it when it is fully grown, that is to say from eight to ten weeks after it has been sown. They should not be put into it when hungry, or they may eat too much at first. It is safer to turn

them in upon it in the morning after the dew has lifted, and when once turned upon it they may be allowed to remain until the field is eaten off. Or, they may be accustomed to it by degrees, putting them on it but a short time at first and then gradually extending the time from day to day, until finally they are allowed to remain upon it all the time.



DWARF ESSEX RAPE. (*Brassica campestris*.)

The second method is the safer, but in dry weather it will not be necessary probably to take so much trouble. The practice of having an old, grass pasture at hand is a good one. The sheep will eat some of the grass, hence the rape is not so liable to produce undue laxness of the

bowels. An acre of rape should furnish forage for from ten to fifteen sheep for two months. At the end of that time the sheep should be fat enough for ordinary marketing. They do not need any additional grain ration when on the rape, nor do they require water, but they must have access to salt at all times.

Rape will also furnish excellent pasture for cattle, but they waste more than sheep by trampling it under foot. There is some danger of injury from bloating, with cattle as well as with sheep, when they are put upon it while the leaves are moist from the influence of dew or rain, and the same precautions are necessary with the former as with the latter when they are first turned in upon it. Many persons prefer to pasture cattle upon rape during a portion of the day only. During the other portion they graze them upon a grass pasture or feed them dry food in the yard or stable.

And rape also provides a very suitable pasture for swine. The swine may be put in upon it at any time after it is far enough advanced in growth, and they may be left in upon it, or allowed access to it at will, as may be desired. Some meal or grain fed in addition will no doubt prove profitable. No danger of injury from excessive eating may be feared with swine, as with cattle and sheep. Rape may also be cut and fed with much advantage as a soiling crop, that is, a crop cut and fed while yet green and succulent, to live stock. It is particularly serviceable when thus fed as a food factor to sheep that are being made ready for the show ring, as a food adjunct for swine, more especially when they are confined to the pens, and also as a food adjunct for milch cows. When fed to milch cows it is safer to feed the rape after rather than before the milking, to avoid the risk of tainting the milk. Rape is an excellent food for producing an abundant flow of milk.

There are several varieties of rape, some of which are grown extensively in Europe for their seed. But the only variety hitherto found highly useful as a forage plant is the Dwarf Essex (*Brassica campestris*), sometimes spoken of as English rape. It does not blossom the same season that it is sown, but bears seed the second season in latitudes where the severity of the winter does not kill it. The Dwarf or Essex rape will not, as a rule, survive the winters of the Northern states or of Canada. Those kinds which produce seed the same season they are sown have not been found profitable as forage crops.

Rape is adapted to all soils suitable for growing a good crop of tur-

nips, that is to say, it will grow well on good, moist loams of free texture. But it will also yield abundant crops on some soils not well suited to the growth of turnips, as for instance the muck soils found in swamps. It requires soils rich in vegetable matter. Rape will grow well on all prairie soils that are rich naturally or made so. But it will not produce good crops on light sands until they are first enriched, nor will it give good crops ordinarily on stiff clays.

The preparation of the soil for rape, the time of sowing the seed, the amount of seed required and the cultivation needed, will depend to some extent on the object for which it is grown, and also to a considerable degree on the place given to it in the rotation. But the place assigned it in the rotation is also modified by the object for which it is grown. When rape is grown as a cleaning crop, as well as to produce forage, it should be sown in raised drills in the east, but in rows on the level in the west, so that it may be cultivated. Where it is the only crop grown upon the land during the same season, the preparation of the soil and the mode of sowing the seed will be essentially the same as in growing a crop of turnips, described in Chapter VI., in treating of field roots, but a less amount of rape seed will suffice. When all the soil conditions are right it is not necessary to sow more than from one to two pounds of rape seed per acre with drill culture. The cultivation may also be the same as for turnips, with the difference that the rape does not of necessity require to be thinned like turnips when a reasonable amount of seed has been used. A long period is thus secured for removing noxious weeds and weed seeds from the upper section of the soil. Owing to the late season at which the rape is sown, the ground may be made measurably clean before the crop is put into the soil,

When thus grown the seed may be best sown in the east from about the middle of June until the middle of July, but in some instances it may be sown later than the date mentioned. In the west and Northwest a somewhat later period would seem to be preferable, when there is sufficient moisture in the soil to start the rape growing. When rape is sown early in the spring a rapid growth may be secured for a time, but as the hot weather of early summer comes on it loses its bloom. The color fades to a pale green or a yellow, and some of the leaves become crisp and dead. It has been claimed that when rape sown thus early is eaten off before arrested development is noticeable, the crop will grow freely again, and the claim may be just, but experi-

ence on this point is as yet too limited in the Northwest to follow it as a safe guide.

When rape comes after a crop of rye which has been pastured, it may be grown as a cleaning crop and to produce forage, or simply for the latter purpose. If sown as a cleaning crop it should be grown in drills, or when the land is not rich the same mode of culture should be adopted to stimulate growth. But where the soil is rich and the one object is to grow forage, it is then sown broadcast and covered with a light harrow. When rape is thus grown, from three to six pounds of seed per acre are used.

Where rape is grown as a catch crop and for forage uses, it is sown variously, sometimes along with cereal grains in the spring. When thus sown, about two pounds of seed per acre are used. In some instances it will not grow to give any profitable return. In other instances it will grow, but not so as to hinder development in the grain crop, and after the latter has been cut, it will come on and furnish a goodly amount of forage. And in yet other instances it will grow so rapidly as to damage the grain crop which has nursed it, so that discrimination must be used as to the soils on which it should be sown when the attempt is made to grow it by this method.

Oftentimes it is sown broadcast on the bare fallow. This is a grand way to grow rape wherever the bare fallow system is practiced. The cleaning of the land for the fallow may commence the previous autumn. By the time that the rape should be sown the fallow will be measurably clean, and it ought to grow a fine crop of rape. The pasturing of the rape will make the land firm, so that a good crop of grain is likely to be grown upon it the following season. The land should not be ploughed again before the grain is sown. This method has succeeded well in Manitoba, and in all the Northwest it should bring with it the opportunity to grow thousands and thousands of acres of rape.

At other times rape may be sown broadcast after some cereal or hay crop has matured and been harvested. It may follow wheat, rye, barley, oats, peas or meadow. When it comes after any one of the cereal crops named the land will simply require stirring with some form of cultivator, if not weedy, but if infested with weeds it will need ploughing. When there is a lack of moisture no good result will follow the sowing of the seed, but if showers come a good crop may be obtained unless on hungry soils.

And at yet other times rape is sown in a crop of standing corn, just before the last cultivating given to the corn. Experience in growing rape by this mode also is limited, and so far as it has gone the results have been fairly encouraging. But further experiments in thus growing rape may prove more satisfactory.

Corn.—Corn more properly comes under the head of fodder crops. Hence the growing of corn is described at length in Chapter V, which treats of this class of crops. But there is a strong probability that thousands of acres of corn will yet be grown in the Northwest to furnish forage for sheep. It would not answer so well, perhaps, to provide pasture for cattle, since they would probably destroy much of the corn while it was being pastured.

When corn is grown to provide forage for sheep, it may be sown on any kind of land suitable for an ordinary crop of corn grown for other uses, as for instance either grain or fodder. It may be grown very suitably in conjunction with rye and rape, that is to say, the corn could be made to follow the rye, and could in turn be followed by rape after the corn had been pastured, providing, first, that the corn was eaten off sufficiently early to admit of this, and second, that there was enough moisture in the soil to secure germination of the rape seed.

When corn is grown for this purpose, it may be advantageous to divide the field or plot into two or three sections. The first section would be sown as early in the season as the corn could be put into the ground with safety, the second at an interval of two or three weeks, and the third at a corresponding interval after the planting of the second plot. The season of pasturing would then be prolonged for a period of two or three months.

The corn could be sown with the grain drill. From one to two bushels of seed would be used. Preference should be given to such of the strong growing varieties as come under the head of sweet corn. When the corn appears above the surface of the soil, it may be harrowed with a light harrow, and the work of thus harrowing the corn may be repeated a second time to keep the weeds in check and to encourage the growth of the corn.

The most suitable stage in the growth of the corn at which to turn in the sheep is yet problematical, but it should not be deferred until the corn gets so high and woody that the sheep will not eat it off readily. The corn would probably require to get as high as the backs of

the sheep before pasturing begins. A crop of corn thus depastured would furnish many tons of green food per acre.

Experience in using corn as a forage crop is almost entirely lacking. With the exception of his own experience, extending over but one season, the writer is unable to furnish that of any other. The data upon which to base any positive conclusion is therefore insufficient. But there is no good reason apparent why corn should not be thus used with great advantage in providing succulent forage for sheep at a season of the year when it is much needed.



And here it may be well to add, even at the risk of digressing, that in the judgment of the writer wide areas in the Northwest are admirably adapted to the growing of sheep. The winters are all that could be desired for this purpose in a country of low temperatures. The only serious difficulty to be confronted arising from conditions which relate to soil and climate is the lack of succulent fodder during the late summer and the autumn months. It is highly important, therefore, that

much attention should be given to the growth of forage crops to carry the sheep on into the winter in a good condition of thrift. There seems to be no good reason why sheep should not be grown in greatly increased numbers and of the finest quality. It would, of course, be necessary to improve the breeding of the sheep as well as to improve the autumn forage.



KAFFIR CORN.

Kaffir Corn.—There does not appear to be any good reason why Kaffir corn should not be successfully grown as a forage crop. It is of

a leafy habit of growth and also bulky, hence it provides a large amount of excellent food. It seems best adapted to warm latitudes and has the power of holding out against the influences of drought in a marked degree. It is becoming quite popular as a soiling and fodder plant in Kansas and other places, but experience in pasturing it seems to be wanting. When grown as a forage crop it may be sown and managed in about the same manner as corn that is grown for a similar use. The mode of growing corn as forage has already been given in the present chapter. When grown for soiling or fodder uses it should be put in drills and cultivated in the same way as corn grown for the silo or for fodder. See Chapter V., where it treats of corn.



JERUSALEM CORN

Jerusalem Corn.—Jerusalem corn, like Kaffir corn, described above, is growing in favor. It may be termed a sort of dwarfish sor-

ghum, as it does not usually reach the height of more than three or four feet. But it does not possess the saccharine qualities of sorghum. It is branching in its habit of growth, and each branch bears a head which in due time matures seed. Like Kaffir corn it is a good plant to withstand drought. Experience seems to be wanting in growing it for forage, but it is at least well worthy of trial for such a use. The method of growing Jerusalem corn for forage uses would be about the same as that of growing Indian corn. See Corn, in a preceding paragraph of the present chapter.

Jerusalem corn is becoming more and more valued as a fodder plant. When used as fodder it may be grown as an ordinary corn crop. See Corn, in Chapter V. The abundance of the grain which it produces greatly adds to its feeding value. Both Kaffir corn and Jerusalem corn furnish very excellent soiling food during the late summer and autumn months.

Sorghum.—Sorghum is chiefly grown for the syrup which is extracted from it, but it is also raised to some extent for fodder, and there does not seem to be any reason why it cannot be grown with manifest advantage to provide forage for sheep. It possesses the power in a marked degree of sprouting up again after it has been eaten off, hence it should provide forage for a much longer period than corn. As it possesses more sugar than corn, it should be much relished by sheep and its fattening properties are of a high order. But the animals must not be put upon a sorghum pasture when hungry, lest they eat too freely and harmful results follow. They should rather be accustomed to it gradually. And this remark will hold true when any kind of succulent pasture is being eaten.

Sorghum may be grown for forage in much the same way as corn, the culture of which has been described in a preceding section of the present chapter. As with corn it would probably be wise to sow the seed at intervals to prolong the season of pasturage. The amount of seed required per acre should not be less than from one-half bushel to three-fourths of a bushel, and in some instances an amount considerably larger could be used with great advantage.

The most suitable stage at which to begin the depasturing of sorghum is yet problematical, and indeed the same thing may be said of the whole question of producing corn as a forage crop. Experience thus far with reference to it seems to be entirely wanting. But, reas-

oning from general principles, there seems to be sufficient cause to expect that large areas of sorghum will yet be grown to provide forage for sheep. It would be well probably to turn the sheep in on the sorghum after it had reached the height of from one to two feet above the surface of the ground.



EARLY MINNESOTA SUGAR CANE OR SORGHUM.

It is somewhat surprising that sorghum has not been more largely grown in the Northwest for forage, soiling and fodder purposes, when

its excellence for these uses is considered. It is true that its value in furnishing pasture is somewhat problematical, since experience is almost entirely wanting on this point. But substantial reasons may be given for the belief that it will yet be very extensively grown as pasture for sheep and probably also for cattle. First, it is a quick growing plant after it has once made a good start. Second, it is a deep and a firm rooted plant, and hence not easily displaced in the soil. Third, it has the power of growing in dry weather in a marked degree; and, fourth, it is pre-eminently *the* forage plant for growing up quickly again after it has been eaten off. But it is also probable that much care would have to be exercised when pasturing it, lest the animals should suffer more or less from bloating.

As to the value of sorghum as a soiling crop, there need not be any doubt. The readiness with which it springs up when cut off pre-eminently adapts it to soiling uses. In some latitudes two or three cuttings may be obtained. It would assuredly furnish a large yield on a given acreage of productive soil.

And its value as a fodder crop has also been proved, though probably not to any great extent in the Northwest. When thus used it may be sown with a grain drill, as for forage. It should be allowed to reach an advanced stage of growth before it is cut where the frost does not come too early. If frozen before it has been cut its feeding value is seriously injured. When cut it should be allowed to lie on the ground in the hot sun for several days, until it is at least partially cured. Should rain fall on it when thus strewn over the ground, it will not take serious harm, as would corn under like circumstances. It may then be thrown into heaps, larger or smaller according as the sorghum is more or less succulent. On the arrival of cool weather it does not spoil when in heaps or coils, as would corn. It is drawn from the heaps and fed as wanted. Immense areas of sorghum will doubtless be thus grown for fodder in the Northwest in the near future.

Sweet Corn.—Sweet corn may be profitably grown as a forage crop for swine. The mode of preparing the ground, the time of planting the seed and the cultivation suitable for the crop are similar to the method given of raising corn chiefly for the grain which it produces. See Chapter V., under head of Corn.

This crop is ready to be fed to swine as soon as the corn in the ear has reached the milk stage, or even at a period somewhat earlier, and

feeding it may be continued until it is so far matured that the swine will no longer consume any considerable proportion of the stalk. If the corn is planted at intervals the season for feeding may be made to extend over several weeks.

When sweet corn is thus fed to swine it is commonly carted to them and fed only as a portion of the ration. To turn them in upon the crop is considered wasteful. It furnishes an excellent food adjunct when given along with grain. If any of the crop remains after it has become too far matured to be fed as indicated, it may be cut and cured for winter fodder.

Mangels.—Mangels may be made to provide an excellent forage crop for swine, and also for sheep. The method of growing them would be the same as described in Chapter VI, under the head which treats of mangels. There would not be the same necessity for thinning them with so much care as when grown for winter use, hence the labor of producing the crop would be materially lessened. A large quantity of food per acre could thus be furnished. When the pastures were dried and possibly bare, it would be a grand thing for a flock of sheep to have access to a crop of mangels. The economical plan would be to allow them to feed upon one portion of the crop until it was eaten clean, and then to give them access to another portion, and again to another, until the whole crop was consumed. And it would be well to so arrange that all the mangels should be eaten before the season of frost becomes sufficiently severe to bring serious harm to the mangels.

Swine also should be allowed access to the mangels, and much after the same plan as suggested above for pasturing with sheep. But they would require some grain or meal in addition to the mangels, more especially if they were soon to be fattened for the market. But with swine it would probably be the better plan where small lots only are kept, to cart the mangels to them and feed them along with other food in suitable quantities, large or small, as occasion may require.

By sowing the seed early, a portion of the crop should be ready for depasturing not later than the middle or end of August, hence the crop might be made to render good service in the manner indicated, for a period of at least two months.

Fall Turnips.—Fall turnips, in an even greater degree than mangels, can be made to serve an excellent purpose in providing forage for sheep, and at a less outlay for labor than mangels. But on the other

hand, this advantage is offset in some degree by the greater certainty with which a crop of mangels may be grown. When the season comes for sowing the turnips, the dry weather oftentimes hinders the seed from sprouting.

Turnips to provide forage may be sown upon the bare fallow or upon new land after it has been broken with the plough. When raised upon the bare fallow, the land could be managed previous to the sowing of the turnips, in much the same manner as though it were to be sown to rape, as described in dealing with the methods of growing rape. When raised upon "breaking," the land would need to be harrowed before and after sowing the seed. The seed would be scattered broadcast, and at the rate of from three to six pounds to the acre. The time of sowing would extend from about July 1st until the middle of August.

No further labor is necessary after the crop has been sown, until it is ready for being depastured. The sheep may be put upon the turnips in, say two months from the time of sowing the crop, when the conditions have been favorable for a good growth. The sheep should have access at the same time to some other kind of food, as a grass pasture for instance, which has not been eaten too bare. More is said with reference to this crop in Chapter VI.

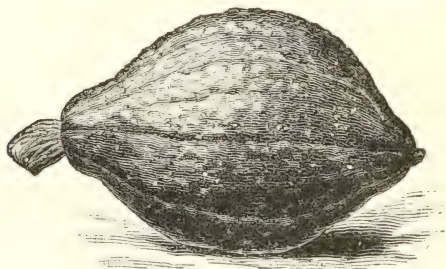
Squashes.—Squashes can be grown with much advantage as a late summer or autumn food for live stock, in nearly all parts of the Northwest. This crop may be more properly termed a soiling than a fodder crop, since it is not consumed in the field where it grew. And it is not strictly speaking a soiling crop, since it is allowed to reach maturity before the squashes are fed. When this crop is grown upon suitable soils, from five to seven tons per acre may be secured with ordinary good management and in a normal season.

Many varieties of squashes may be grown, but those which have a moderately soft rind and thick flesh, and which grow to a good size are preferable. The Boston Favorite is among the more suitable varieties.

Field squashes, and indeed any kind of squashes, grow best in friable loam soils of sandy texture. But they will also grow admirably on muck soils when free from a superabundance of water, owing to the large amount of humus or vegetable matter which they contain. Squashes will grow well on what may be termed good, rich "corn":

soils. It is useless to plant them on poor soils with the expectation at the same time of getting a good crop.

The preparation of the soil for a crop of field squashes is essentially the same as for a crop of corn, see Chapter V. But there is this difference. On soils that are not leechy the ground should be marked off both ways in the autumn by drawing lines over it with some kind of marker at intervals of eight feet. At the points of intersection two or three shovelfuls of earth are taken out and laid aside. A good large forkful or more of well fermented farmyard manure is put into the cavity made, and the earth which was removed is put back in place. To preserve the exact spot where the lines intersect, it may be well to use small pegs or stakes placed upright in the ground. On leechy soils, the marking out of the ground and the application of the manure had better be delayed until the spring. The ground should be harrowed occasionally in the spring until the squash seeds are planted.



BOSTON FAVORITE SQUASH.

The planting of the seed should be deferred until the soil is warm and all danger from spring frosts is past. The time of planting, therefore, may commence during the latter part of May, and can be extended well on into the month of June.

The seeds may be put into the soil with the hand corn planter, and care should be taken to cluster them around the spot enriched with the manure. In other words the hills should be in straight lines which do not extend widely, for the sake of convenience in the after cultivation. From six to eight or ten plants may be put into a hill, to make sure that there will be no blanks, but before the plants crowd each

other in the hill, they should all be removed but three or four of the strongest ones. From three to four pounds of seed per acre will be sufficient.

Cultivation should begin soon after the seed has been planted, to keep down all weed growth. It should be shallow and frequent until it is hindered by the vines running over the soil. Some hand hoeing will probably be needed around the hills.

When ready for feeding the squashes are carted to the feeding place. Although excellent for milch cows, it is more common to feed them to swine. They are at once a nutritious and palatable food. When fed to swine that are being fattened, they should only form a moderate proportion of the whole ration. They are especially valuable when fed to pigs confined to a forcing ration of corn, because of the favorable influence which they exert upon digestion.

Field squashes may also be grown along with a crop of corn. When thus grown, planting them in the corn is usually deferred until the corn has been harrowed, which should take place soon after it appears above ground. If planted as early as the corn, the squash vines would probably interfere with the cultivation of the corn. A crop of squashes grown in this way is therefore later than when it is the sole crop on the ground, and the squashes are of a smaller size.

Pumpkins.—Pumpkins may be grown after the same manner as squashes, and they may be devoted to the same uses, but pumpkins are more in favor as a food for milch cows than for swine. It is more common also to grow the pumpkins along with corn, or even with potatoes. But the frequent harrowings now recommended for both corn and potatoes will certainly tend to discourage the effort to grow them along with either of these crops.

When an orchard has reached that stage in which it is thought prudent to cease growing cereals upon it, and at the same time it is considered advisable to stir the soil in the same to a greater or lesser extent during the spring and early summer, a crop of pumpkins or squashes may be grown with manifest advantage. The shade of the orchard is probably helpful to the crops named, and these in turn protect the soil so as to keep it more moist than it would otherwise be.

Peas.—Field peas may be grown as a forage crop, particularly for swine. If pastured by other kinds of live stock much of the crop would be wasted. It would be trodden down and soiled, hence the

soiled portions would be left uneaten by sheep and cattle; but with swine the waste of food will not be nearly so great.

This crop is peculiarly adapted to temperate climates, humid rather than dry in character, and cool rather than very hot in the summer. It will grow readily in nearly all parts of the Northwest, but in the southern portion of the Northwestern states lying along the Canadian boundary, average yields may not be looked for, equal to those in the northern portion of the same states, or on the Canadian side of the line, although in some seasons good crops may be secured further south than the northern tier of states. Hot winds are very hurtful to the yield of grain from peas, if they pass over the crop when it is in blossom. The pea crop therefore may in some instances be made more profitable as a soiling crop or fodder crop than when grown for the grain.

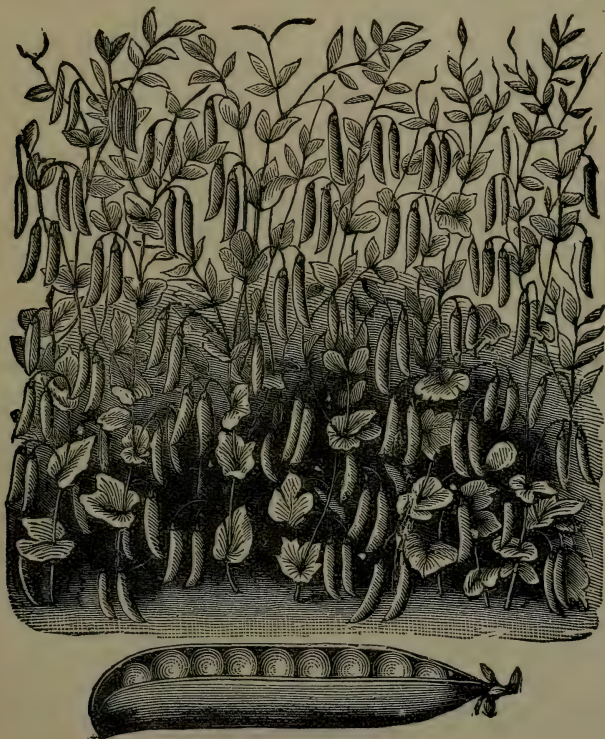
Of this crop there are many varieties. When grown as forage for swine, those kinds which give good yields of grain should be preferred. When they are grown as a soiling crop or for fodder uses, choice should be made of those kinds which produce large quantities of straw, but not of too coarse a character.

Peas will grow on nearly all classes of land free from stagnant water, but not equally well. They flourish on lands essentially clay in texture, as such soils usually have a plentiful supply of available potash. On light sands they do not produce straw plentifully, and on humus soils, with an excess of plant food, they grow an abundance of straw, with a corresponding deficiency in the yield of grain. This crop, like clover, has the power of taking nitrogen from the air, hence it is not an exhaustive crop on the land.

To produce forage, peas may be sown early or late, and indeed for any purpose they may be thus sown, but, notwithstanding, it would be easily possible to delay the sowing season so long that only reduced yields could be looked for. It would perhaps not be prudent ordinarily to defer the sowing of peas longer than the middle of May. When sown as a food for swine the season of depasturing may be prolonged by planting the peas at intervals, that is, by sowing one part of the crop early, a second portion about two weeks later, and a third portion about two weeks later than the second.

The method of preparing the ground for a crop of peas is the same as for other cereals. The seed should be sown with the grain drill,

and it should go down deeply into the soil. When a grain drill is not available, the peas may be sown broadcast over the land and then ploughed in to the depth of four inches. The land should then be smoothed with a light harrow. If again harrowed a few days after the



N., B., G. CO.'S CHANCELLOR FIELD PEA.

peas have been sown, and while the sprouts are yet some distance below the surface of the ground, the growth of the weeds will be checked and that of the peas will be strengthened.

The amount of seed required will be the same as though the peas

were to be raised for the grain. It will vary with the variety sown and also with the character of the soil. When the small varieties are used, two bushels of seed per acre will suffice, but with the largest sorts three bushels and even a greater quantity may be used. Less productive soils require more seed than those more fertile.

Peas are ready for being pastured when they have reached that stage which renders them fit for table use. It is considered best not to allow the swine access to the whole of the crop at once, but rather to restrict them to one portion until that is eaten, and then give them access to another part. When the peas are matured, the gleanings of the swine may continue until all the crop has been gathered, although some persons are opposed to the further gleanings of the swine after the peas have matured, as then this mode of harvesting them is wasteful of the straw. The season during which peas may be thus used as a forage crop is not a very long one.

Barley and Oats.—Barley and oats, grown together, furnish excellent pasture for swine at a season of the year when blue grass has passed the succulent stage. The mixed crop of these two varieties of grain will grow on any soil suitable for producing one or the other of them. The preparation of the soil is the same as though they were grown for the matured grain, that is to say, the ground should be ploughed in the autumn when practicable. The seed is first mixed before being sown. The proportion of three parts barley to one part of oats will be found suitable. From nine to twelve pecks of the mixture may be sown. The aim should be to put in the seed with the drill.

The crop is ready for pasturing when it is sufficiently grown to almost hide the ground. It should be cropped off before any indications of earing manifest themselves. If allowed to reach the earing stage the forage would be less relished by the swine and further growth from the root would practically cease. When a part of the crop is sown early and another part at a later stage, the season of depasturing is prolonged. Barley and oats thus grown together make an excellent substitute for clover where the latter has failed to grow or where it can not be depended upon to produce a successful crop, as in latitudes north of the clover belt.

Mixed Grains.—The different cereals may be mixed and sown together to provide food for live stock. When thus grown they may

be mixed in various ways to suit the capabilities of the soil and the needs of the live stock kept. More food can be obtained, as a rule, from grain grown in mixtures than from the kinds used in the mixtures had they been sown separately. And there is the further advantage that variety in the foods provided for live stock proves more wholesome than sameness of diet. Those kinds of grain should be made prominent in the mixture which produce most successful results in the locality, and next to this consideration, prominence should be assigned those which are more particularly suited to the needs of the live stock to which they are to be fed.

The mode of preparing the soil for these mixtures of grain is much the same as it would be for growing them singly. In the heavier soils of the New England states and Canada deep ploughing in the autumn would be in order. In the Central states, which lie to the north, as Ohio for instance, the ploughing would have to be delayed until spring lest the land should become impacted by heavy rains. The soils of the Northwest should also be ploughed in the autumn like those of New England, but as a rule they should be ploughed shallow rather than deep. Farm-yard manure may be used with much freedom when raising these crops, for soiling. They are cut before the grain is matured, hence an excessive growth of straw is not so hurtful to the crop as though it were grown for the grain which it would yield.

These crops are also helpful in cleaning the soil. They may be made to grow so thickly as to keep weeds in check to some extent. And as they are commonly cut and fed while green, there is time enough to follow with another crop the same season.

Peas and Oats.—Of the various mixtures grown for soiling uses, none are in such general demand as a mixture of peas and oats. The amount of this mixture to be sown per acre will vary, but one bushel of peas and one and a half bushels of oats will probably prove satisfactory in nearly all instances. The peas may be sown first and deeply buried; then the oats, which should not be buried so deeply. But when these grains are first mixed and then sown together with the grain drill, the germination will usually prove satisfactory when they are well covered. The covering may be less on stiff soils than on the lighter soils of the prairie.

And here it may be mentioned that in the judgment of the writer greatly increased attention should be given to growing peas, whether

they are grown for grain, for soiling uses or for fodder. Like clover they have the power of enriching soils by depositing in them nitrogen which has been obtained from the air. And in sowing them for any purpose, it should be remembered that the larger the grain the greater the quantity of seed required. While two bushels of seed of some varieties may be ample to sow per acre when the grain is the chief object sought, more than three bushels per acre of some of the large varieties would not be too much to sow.

But the scarcity of seed and the lack of harvesting facilities are serious obstacles to the extension of the growth of the pea crop in the Northwest. The remedy for the first is in the hands of the farmers. When they set about growing more of this excellent crop the seed will be more plentiful. And the remedy for the second has already been solved by the inventor. Pea harvesters are now being introduced in sections where peas are grown largely as a grain crop. They will cut the peas as quickly as a mower will cut meadow, and they are not costly.

When soiling crops are sown at intervals rather than all at once, the season during which they may be fed is prolonged. But experience has demonstrated that it is better to grow a succession of various soiling crops adapted to the different seasons, than to try to prolong unduly the period for using any one crop. For instance it would be better to grow peas and oats followed by corn, than to try to so lengthen the period of growing either of those crops, that the growth of the other would not be necessary. All crops will grow better at a certain season of the year than at any other time, and the aim should be to grow each in its proper season. Peas and oats should be sown quite early, and then again at an interval of two or three weeks.

The feeding of this crop may begin when the oats are well out in head or when the peas are in full bloom, and it may continue until the grain is nearly matured. When the grain has reached what might be termed the dough stage, the crop has then attained its maximum feeding value. It can be cut with a scythe, a mower, or with a reaper as occasion requires, and where large quantities were in demand it would need to be carted to the place for feeding. It furnishes excellent food for milch cows, and may also be fed with advantage to other kinds of live stock.

Oats and vetches or tares make an excellent soiling food for sheep

and lambs, and they may also be used with advantage in feeding swine. In nearly all parts of the New England states and Canada this crop can be grown with much success, but in some sections of the west and Northwest the warm winds that occasionally visit those regions are hurtful to the vetches. In other seasons they will grow very well. One peck of oats and from two to three pecks of vetches per acre will furnish an abundant seeding. The seed may be sown with the grain drill as soon as the weather has become settled in the spring, and again at an interval of two or three weeks. The oats are wanted rather to sustain the vetches from falling to the earth than to provide food for the sheep, but they will be eaten in part by the sheep, although these animals show a decided preference for the vetches. As soon as the vetches reach the blossoming stage the feeding may commence.

Oats and wheat, or oats, peas and wheat, make an excellent soiling crop. The cost of the seed should be considered in determining the relative amounts of each to use in the mixture. From two and a half to three bushels per acre may be sown of the whole mixture. When it consists of oats and wheat equal proportions of each can be used. When it consists of the three cereals named, equal proportions of oats and wheat may be used, and half the quantity of peas. In other words, the oats, wheat and vetches would be mixed in the proportion of two, two and one. These grains are mixed before being sown, and should be put into the ground to a fair depth to keep the peas from being uncovered by the washing of rains which may follow. Like the mixtures for soiling previously mentioned, they should be sown early, and again at an interval of two or three weeks where prolonged feeding is wanted. The feeding of the crop should commence as soon as the heads of the oats and wheat begin to appear.



CHAPTER V.

FODDER CROPS.

The production of fodder crops will no doubt form an important factor in the farming of the Northwest, in the near future. The need for this class of crops is not yet so apparent as it will be in the days that are at hand, owing to the abundant supply of wild hay available in all the more newly settled portions of the country. When the lands which yield wild hay come to be cultivated, a substitute for the crop which now grows upon them will be required. This substitute will be found in part in cultivated hay, but more probably in fodder crops, owing to the marked adaptability of the conditions of growth in all this western country to the production of these crops. In growing fodder crops there is not the same liability to occasional failure in the germination of the seed, as in growing crops of hay. Some of them, for instance corn, when once firmly rooted in the soil, possess great power to withstand the vicissitudes arising from dry weather,

Corn.—Sometime in the future, possibly at an early date, the corn crop will doubtless stand first in importance among all the fodder crops then grown in the Northwest, hay even not excepted. In some sections of the area named corn may not as yet prove a reliable crop when raised mainly for the grain which it produces. But when grown purely as a fodder crop there are but few sections capable of tillage which may not be made to produce it in good form. At one time it was thought impossible to grow corn with safety further north than Minneapolis. Now good crops are regularly grown a hundred miles further north and the northern limit fixed upon for its production is constantly receding from the equator. Excellent corn of the Mercer variety was harvested the present year at Buxton, Traill County, North Dakota, situated

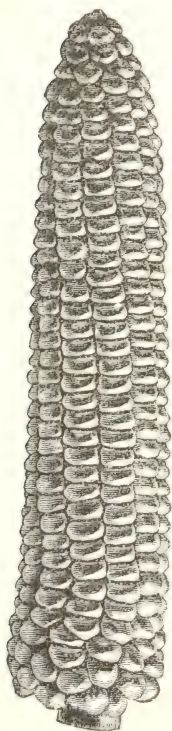
about half way between the forty-seventh and forty-eighth parallels of latitude, and at numerous other points in that state. When a crop of matured corn can even now be obtained thus far north, we have reason to hope that varieties will yet be procured, which under a proper system of cultivation will mature the crop with considerable certainty throughout the regions along the southern boundary of Manitoba and Assiniboia. And as corn can be grown for fodder, and more particularly for soiling, much further to the north than for grain, we can confidently anticipate that for these purposes it will become a regular product of the Canadian Northwest.

Benefits other than the food product obtained would be derived from the general growth of corn. In the first place if properly cared for it would greatly assist in the cleaning of the land. But on the other hand if the cultivation were neglected it would prove a most effective medium for the multiplication of weed seeds. Therefore when it can not be properly cared for the attempt should not be made to raise corn. And this remark will apply to the growth of all kinds of crops. In the second place it will furnish an excellent seed bed for grass seeds. And in the third place corn culture brings the land into good form for producing more abundant cereal crops than if corn were excluded from the rotation.

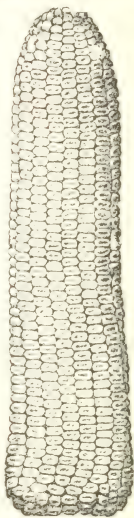
Corn is of many varieties, and the number of these is probably not less than four hundred. The varieties may be roughly grouped into four classes, viz: first, the flint varieties, so named from the hard condition of the grain when ripe. The earliest maturing sorts generally belong to this class. Second, the dent varieties, so called from the depression on the outer end of the kernel. The best yielding sorts are commonly found in this class. Third, the horse-tooth varieties, so named from the resemblance which the kernel bears to the tooth of a horse. These varieties are also included in some one of the aforementioned classes, but frequently in the second or the last named. Fourth, the sweet varieties, so called from the saccharine nature of the corn and also of the stalk. Nearly all the kinds grown in the garden belong to this class, but it includes some sorts suitable only for field culture.

The varieties of corn best adapted to the Northwest when grain only is wanted, or even when grain and fodder combined are sought, include the Squaw, Mercer, Smut Nose, Minnesota King, Dakota Dent,

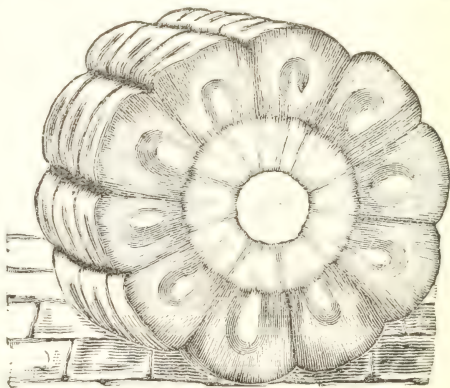
Pride of the North, Huron, Rustler and Mastadon. The Squaw corn, a white flint variety, which stands first in point of earliness, and hence is grown further to the north than any other, is dwarfish in character, and therefore not a satisfactory kind of corn to cultivate where more productive sorts will mature. The Mercer, a yellow flint variety, is not only early but a prolific producer as well. The ear is a good size, the cob small, and the corn on the same is firm. The Smut Nose is a yellow flint corn, but the grain is tinged with a reddish cast near the tips of the ear. It is also highly productive. The Minnesota King, a yellow half-dent corn, seems to possess the power of resisting drought in a marked degree; better it has been claimed than any other sort. It was introduced into Minnesota by the Northrup, Braslan, Goodwin Co., in 1889. The Dakota Dent is said to be the earliest of the pure yellow dent varieties. It originated through a careful and persistent selection of



MERCER CORN.



DAKOTA DENT.



Section of ear N., B., G. Co.'s Minnesota King Corn.

the first matured ears from the Pride of the North, and hence it may be grown further northward than that variety. The Pride of the North, a pure yellow dent corn, has long been popular in latitudes east, south and west of Minneapolis. The Huron is a yellow dent which furnishes an abundant yield. It is as early as the Dakota Dent, and both stalk and ear are of good size. A white dent corn known as the Rustler originated in Dakota. The ears are of compact form, and it is also an early maturing sort. The Mastadon, as indicated by the name, produces a large ear and one possessed of great weight, owing to the many rows of deep kernels which cover the cob. It is a yellow dent variety, and by no means a late one, hence will answer well for growing south of Minnesota.

Among the standard late varieties may be mentioned the Golden Beauty, the Improved Leaming and the Champion Pearl, all excellent sorts to raise where they can be matured. Of those grown only for fodder purposes the Giant, Red Cob, Elephant and Evergreen Sweet are prominent.

Corn may come anywhere in the rotation, but the object should be to grow it so that as far as practicable it may be made a cleaning crop, hence those fields may be chosen for a corn crop, which in the absence of a cultivated crop would require to be summer fallowed. It may be put upon overturned sod with much advantage to the corn. But when thus grown the aim should be to plough the land the preceding autumn. The decaying vegetable matters in such soils furnish a very suitable food for the corn, they too enable the ground to better retain the moisture which it possesses. And it should almost invariably be followed by a cereal crop sown with grass seeds. The cleaning of the ground by the cultivation of the corn is so far an excellent preparation for these crops. The cultivation also renders the soil more dense, providing it is stirred only on the surface in preparing for them, after the removal of the corn. The ploughing of the land at any time after the removal of the corn and prior to the sowing of the grain crop which follows, would so loosen it that the surface evaporation would be greatly increased. Inert plant food, that is plant food lying in the soil in a condition inaccessible to plants, is liberated by the cultivation given to the soil, in conjunction with atmospheric and other influences. When thus liberated the grain which comes after the corn takes up this food readily, providing it is left near the surface. But when it is buried by

ploughing the ground, and more especially by ploughing it in the spring, the roots of the grain crop which follows are just so far hindered from reaching the food thus liberated until a later period.

Corn is grown, first, for the grain which it produces, or for the grain and straw used separately; second, to furnish dry or cured fodder; and third, to provide what may be termed succulent fodder in the form of ensilage. Where the corn may be expected to mature safely, the same method of cultivation can be adopted in growing it for these respective uses. But even in such localities there may be sufficient reasons for raising it somewhat differently for the first named use, as it may be necessary under some conditions to plant it more thinly than when it is grown for fodder.

Corn will flourish on what may be described as a deep, rich, warm, mellow soil. It luxuriates in rich loams, preferably those somewhat sandy in texture. It grows vigorously on humus soils, but on these it is a little later in maturing. Corn is not so well adapted to stiff clays, but fair average crops may be grown on clay if a vigorous, timely germination can be secured. It will not yield good crops on light, poor sands until they have first been enriched, nor are soils underlaid with gravelly subsoils, which come near the surface, well adapted to the growth of corn, more especially in the Northwest, as they fail to sustain the supply of ground moisture in a dry season. A very large proportion of the soils in the Northwest are pre-eminently adapted to the culture of corn, owing to their free working character and to their richness in plant food.

The preparation of the soil will depend in some measure upon the place assigned the corn crop in the rotation. When it is to come after a grain crop the ground should be ploughed as soon after harvest as the work can be done. The ploughing should be fairly deep, as corn is in its habits of growth a deep feeding plant. When ploughed early the soil recovers to some extent its former density, hence surface evaporation is reduced. When the stirring of the soil subsequent to the ploughing of the land and before the arrival of winter will tend to remove weeds from the soil, an effort should be made in order to accomplish the desired end. In the spring an occasional stirring of the soil before the corn is planted will still further aid in removing the weeds from the same. And it will render the land more moist unless when the weather is showery. Weeds can be more easily destroyed before than

after the planting of the corn. When a clover sod is turned under the work may be done in the autumn or in the spring. If deferred until



N. B. G. CO.'S GIANT FODDER CORN.

the spring the clover should be allowed to make a good start before the

land is ploughed. The decay of vegetable matter in the soil will then be more rapid.

When farmyard manure may be obtained no more suitable fertilizer can be applied to a corn crop. The amount of this fertilizer to apply will depend on the character of the land. Some soils rich in vegetable matter may not need any. Some require only a moderate dressing. Others, more especially leechy sands, may be benefitted by an application as heavy as from 15 to 20 tons, that is to say from 15 to 20 ordinary loads, per acre. In the Northwest the aim should be to plough under the manure in the autumn that it may have a chance to decay. In the East where autumn and spring rains are frequent and abundant it would be better to apply the manure on the surface in leechy soils, otherwise much of its valuable constituents would be washed down through the soil into the subsoil, whence they would escape in the drainage water. If farmyard manures are applied in the winter to land intended for corn, they ought to be turned under quite early in the spring to induce fermentation. Artificial fertilizers do not seem to be much needed as yet by the average soils of this country, but in the east they render substantial service. When the manurial resources of the Northwest now available have first been carefully utilized, it will then be necessary to give attention to artificial fertilizers. But even now, on light and poor soils, more especially on those which are near good markets, such fertilizers may be applied with profit. The nature of the fertilizer to be used would depend upon many conditions, though ordinarily what is known as a "complete" fertilizer would prove suitable for a corn crop. A complete fertilizer is one which contains all three of the most requisite elements of plant growth, viz: nitrogen, phosphoric acid and potash.

The time for planting corn will vary with the climate, locality, soil, and in some few instances with the variety of the corn. It can serve no good purpose to plant corn in any climate until the ground has become warmed to the temperature of from 52° to 54° Fahrenheit. The exact temperature of the soil may be ascertained by burying a thermometer in it as deeply as the corn is to be planted, and leaving it there for several hours. Some soils, as for instance light sands, warm more rapidly than others. But even though the soil should be warm, it is unsafe to plant corn until the season has become so far advanced that the young plants are not liable to be cut down by frosts. When thus cut

down they will come up again, but the results are not likely to prove so satisfactory in the end, as with corn planted late enough to escape spring frosts. In the Northern states east of Michigan, and Canada east of Lake Huron the normal season for planting corn ranges from May 10th to June 5th. In Southern Wisconsin, Southern Minnesota, and South Dakota, the same dates would probably cover the most favorable season for planting. But for some uses, soiling for instance, corn may be planted later than the dates named. In Northern Wisconsin, Northern Minnesota, North Dakota and Manitoba, the normal season for planting will be found near the end of May. The germinative power of corn is easily injured, even after it has been put into the soil, hence, when seed of the first quality has been planted before the ground has become sufficiently warm, the germinating power of the seed is liable to be much impaired, if indeed not wholly destroyed. And where the injury to the seed is only partial, the growth of the young plants will be feeble and delicate. Similar results will ensue when corn is planted on soils sufficiently warm, if the seed time is followed by a long period of cold, raw weather. It is more judicious, therefore, to delay planting corn for uses other than selling in the early market, until there is a strong probability that it will come up quickly after it has been planted, and make rapid progress.

Seed corn should be tested by the seedsman, and also by the grower, before it is planted. And it is not enough to be assured that the corn will grow. The character of the germination is quite as important as the power to germinate. When seed has been carelessly selected and improperly kept, every kernel may be possessed of the power to germinate, and yet the germination will be so delicate that the young plants cannot make vigorous growth until the time arrives when they are wholly dependent upon the soil for sustenance. The ultimate full development of the corn may thus be seriously hindered. It should always be tested by the grower, even though previously tested by the seedsman, as it may in some instances be injured in transit, and there is perhaps no better method of testing it than by planting a few kernels in a box of earth, and placing the box in a warm room where there is plenty of sunshine. It should of course be kept sufficiently moist.

Corn may be planted by hand, with the planter used by hand, or with that drawn by horses, or it may be sown with the ordinary grain

drill. In the absence of machinery, the first method will have to be adopted. Hand planting in either of its forms is more commonly restricted to the planting of corn grown on small areas, and in instances where grain production is sought rather than fodder. But in the absence of machinery for planting, corn may be sown by hand, for soiling and fodder uses. When it is thus sown, shallow drills are first opened with the plough, and the corn is strung along these by the hand in a string like row. A harrow driven across the drills may be used in covering the corn.

When corn is grown chiefly for grain, it has been usual to plant it in hills equally distant from one another in the line of the row, and also between the rows. Where hand planting is a necessity, the ground is first marked off into squares. The hills are placed at the angles of the squares. The proper distance between the hills is determined by the strength of the soil, the nature of the climate and the variety of the corn. The stronger the soil, the more prolonged the season of growth, and the larger the variety, the further apart should the hills be placed, and *vice versa*. They are more commonly placed about 42 inches apart, when the varieties used are of medium development.

Should corn be reared for soiling uses, for winter fodder or for the silo, it is more commonly sown in rows, and the grain drill is used in planting it. This method is sometimes adopted when it is grown principally for the grain. In planting the corn, the tubes of the drill are all closed, except those required to deposit the corn. The distance between the rows will vary even more than when the corn is grown in hills and chiefly for the grain which it produces. for the following reasons:—First, the objects aimed at in growing the corn are more varied, hence it is not only permissible, but positively necessary to grow more kinds, and this necessitates greater variation in the distance of the plants from one another. Second, the fodder portion of the crop is relatively more important, hence to obtain a greater bulk of this proportion, some sorts may be grown more closely than would be admissible if the grain were the principal object sought. Third, in northern latitudes where the grain cannot be matured, preference should be given to early varieties, and these being smaller than many of the late ones can be planted more closely. Fourth, when corn is to be fed as a soiling crop, it may be grown more compactly even than when raised for winter

fodder or for the silo. But in localities where corn can be relied upon to mature, it may be true that the food value of a crop grown as widely as would be necessary to secure a full crop of grain, would be equal to that of the same variety of corn when grown closely. If corn is desired for the silo the aim should be to secure that degree of maturity which will bring the grain to the roasting stage.

In planting corn, much attention should be given to the distance between the rows, and between the plants in the line of the row. Various experiments have gone to show that as much food in weight can be obtained from a small variety as from a large one, by simply varying distances between the rows in planting the seed, and varying the amounts of seeds used. This fact is possessed of much significance when applied to those latitudes in which the seasons are too short to mature the larger and later varieties, and are yet quite long enough to ripen perfectly some of the smaller and earlier varieties.

The amount of seed to be used will depend upon different conditions, as for instance the variety of the corn, the character of the soil and the end for which the crop is grown. When planted in hills from two to five kernels are placed in each hill. On good soils three good stalks in a hill are considered sufficient. One peck of seed per acre would be more than sufficient to produce three stalks in each hill unless the kernels of the seed planted were unusually large. When the seed is sown with the grain drill, from one peck to one-half bushel of seed is used. Twelve quarts probably may be named as an average amount. But if the corn is desired for soiling purposes a larger quantity should be sown.

The depth to which seed corn should be planted will depend upon the character and condition of the soil, and on the climate. The colder, moister and heavier the soil, the shallower should be the covering of the seed, and *vice versa*. Two inches may be termed an average depth, but on prairie soils the seed may commonly be buried to a greater depth with manifest advantage.

Soon after the seed has been planted the ground can be harrowed, even before the corn has appeared, if there is any likelihood of the weeds getting ahead of the corn. It may not be necessary in all instances to use the harrow before the corn has come through the ground. But in any case this implement ought to be used from two to four times after the corn has appeared, and before it has become more than say

from five to six inches in height. The harrow should be light of draught, possessing a large number of short teeth, with a backward rather than a forward slant, and it should be so constructed as to cover a wide space of ground. The free use of the harrow not only tends to destroy the innumerable weeds, but it enables the soil to retain ground moisture which would otherwise escape, hence it materially promotes rapid growth in the corn.

Cultivation should begin immediately when the plants have become too far advanced to longer admit of the use of the harrow upon them. The corn will receive benefit from being cultivated as often as once a week, and in some instances more frequently. The cultivation may be moderately deep at first, but deeper in stiff than in light soils. In every instance it should come as near as possible to the line of the row without disturbing the plants, and as the season advances should be less wide and more shallow. Ordinarily it may be continued until the corn is beginning to tassel freely, but in very dry seasons the crop may receive much benefit by extending the period of shallow cultivation considerably longer. The benefit will be apparent not only in the marked increase in the yield of grain, but in the prolonged greenness and fuller development of the stalk. Level cultivation will be found most advantageous. The practice all too common of ridging the corn when the last cultivation is given to it affords a good opportunity for numerous weed seeds to spring into life, leads to rapid surface evaporation from atmospheric influences, and is hurtful to the crop in other ways. Where due attention has been paid to the growth and management of corn as regards careful cultivation but little hand hoeing may be necessary, and in some instances none may be required. But it should be an inviolable rule with the good farmer not to permit weed seeds to mature in any cultivated crop.

The stage at which the corn can be harvested will depend upon the use to be made of the crop. When it is to be fed as a soiling crop to sheep the feeding may commence before the tasseling season. If it is to be fed as a soiling crop to cattle, the feeding had better be deferred until the corn is in tassel, and it may then be continued until the crop is matured. When the corn is to be fed as a soiling crop to swine it is common to allow it to reach the milk stage on the ear before commencing to feed it, but it may be utilized with advantage at an earlier period where the necessity arises for so doing. When the crop is in-

tended for winter fodder the corn in the ear should be matured before the cutting takes place. It would be preferable to harvest the corn when not quite ripe rather than when too mature, as then the stalks would be relished much better by the stock. If corn is to be placed in the silo it should be cut when the ears have reached the roasting stage. When cut short of this period the ensilage will not be so sweet nor will its feeding value be as great. When cut after the period indicated some difficulty may be found in keeping ensilage free from dry mould. Where the crop is to be husked it should be fully matured before being harvested. When the season of full maturity is passed the loss in feeding value of the fodder begins at once. In case the corn has been seriously injured by frost further maturing will be arrested, hence no good can come from delay in cutting the crop. Providing frosted corn is cut at once and put into the silo, it is thought that it receives but little injury from having been frozen.

Various methods of harvesting corn have been adopted. Sometimes it is cut by hand with the corn hook. This method of cutting has been more commonly resorted to than any other. Oftentimes it is cut with a sled with adjustable knives attached to the sides of the same and drawn by a horse. Two men stand upon it and catch the corn while it is falling and lay it off in sheaves. One or two rows can be cut at a time, as desired. In other instances corn is harvested with a binder, but the machines thus utilized have not yet been so perfected as to do uniformly good work.

Should the corn be wanted for the grain or the winter fodder, it is put into shocks or stooks as soon as cut. Sometimes it is first bound into sheaves. These may be tied with twine, with rye straw or with the stalks of corn. But more commonly the corn is stood up with the aid of a "horse," that is to say, with the aid of a pole about twelve feet long, with legs so placed under one end as to raise it up about one-half the height of the corn, or not quite so high. A small rod, such as a broom handle, for instance, runs through the pole not far from the elevated end. The corn is stood in the four corners or four angles thus formed, with an inclination of the tops to one another. These cone-like shocks are then bound near the tips once or twice with twine, rye or corn. The dryer the climate and the more mature the corn the larger may these shocks be made. When the corn is husked in the field the straw of two or more of these shocks is put together in one, for

better protection against adverse weather, be it over dry or over wet.

The practice has been common heretofore, in corn-growing sections of the west and Northwest, to snap off the ears from the stalk and throw them into the box of a wagon, systematically driven through the field, and then to leave the fodder or stover in the field, to be ploughed under after it has been eaten in part by the cattle. This plan, though economical of labor, is wasteful of fodder, and in time will probably be abandoned. That recent invention known as a shredding machine will likely soon be made to husk much of the corn raised in the near future, and it is more than probable that it will be also much used when preparing the stover for feeding. In the meantime, however, the good old-fashioned way of husking the corn in the field from the stooks and then tying the stover in sheaves is likely to be continued for some time to come, when but small quantities are grown.

No better place can be found for storing the corn itself than a corn crib; that is to say, a building the walls of which have small spaces or openings between the boards which form the walls, and even the floor of the same. There is then opportunity for a sufficient current of air to pass through the corn all the time to prevent it from moulding, even when put into the crib in a fresh state. If corn be piled up on a floor, or deposited in a deep bin in the autumn, it is sure to mould in a greater or less degree.

The question of the value of storing corn in the silo, as compared with curing it in the field, has been much discussed. Entire agreement of opinion need not be looked for, since it is largely a question of conditions. In climates where rains are frequent in the autumn or winter, and in which deep snows or storms are not uncommon, it should be the aim to cure corn in the silo. Under all conditions it is probably the most economical method of curing corn when fed in a large way. But the necessity for silos is not so much felt in regions of light precipitation at that season when the cut corn fodder is exposed. It is very convenient to feed corn from the silo, and no mode of storing it under cover is so economical of room. Silos will doubtless become much more common in the Northwest than they are at present.

No method of keeping corn fodder from the time of harvesting until required for feeding purposes, is superior, all things considered, to that of leaving it in the field until desired for use, and then drawing it to the feeding place. The mode of conveyance will vary with the dis-

tance which it will have to be drawn, and the way in which it will require to be fed. The sled, the stone boat, the chain and the wagon will all render excellent service in conveying corn under certain conditions.

When corn is put in the silo, it is common to run it through a cutting box, driven by steam or horse power. If the corn has reached the roasting stage, it may be put into the silo at once. Where not so far advanced, it may be allowed to wilt before putting it into the silo, and the degree of the wilting should be in proportion to the greenness of the corn. When the corn can be drawn to the silo with low trucks and a platform cover or rack, the labor of loading it is much lessened. The corn is spread evenly in the silo, and is trampled by the person who spreads it, particularly around the sides, and most of all in the corners. To cover the whole ground relating to corn and the silo would require a large volume on this subject alone.

Millet.—Millet, like corn, is a child of the sun, hence when it once gets a good start, it can stand drought and heat fairly well. It seems peculiarly adapted to prairie countries, and yields large crops of palatable and nutritious food. It may be sown in a sense as a catch crop, and at a season of the year when labor is not so pressing on the farm as at some other times. The time therefore, is not likely to come when millet will cease to be a prominent fodder crop in Minnesota.

Millet furnishes an excellent food for feeding in the green state; that is, on the soiling principle. It makes excellent winter fodder for horses, milch cows and other cattle, also for sheep, if cut and fed at the right stage, and when at the same time it is properly cured. But if allowed to become over-ripe, it soon gets woody and consequently unpalatable, and when dried too much in the sun while being cured, its feeding value is greatly impaired. The seed furnishes good food for all kinds of livestock if judiciously fed, but when the crop is allowed to ripen, the feeding value of the straw or fodder portion is very much lessened. The idea has gained currency, that if millet be fed freely and continuously for a long period, impaired digestion may arise in consequence, and that there is danger of the urinary organs being affected adversely. But these results are not likely to follow when the millet has been properly harvested, and when at the same time it is only fed as one factor of the food ration.

It is of several varieties, and prominent among those suitable for

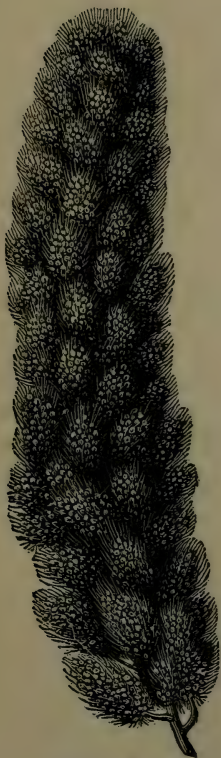
the Northwest are the Missouri or Common millet, German millet, Hungarian grass, Golden Wonder millet, and Broom Corn millet. The Common millet grows much seed, but does not yield so much fodder, nor so valuable as some of the other varieties. The German millet grows strongly and is of a leafy habit of growth, hence it provides most excellent fodder. And it may be mentioned here in passing, that where the seed sown is of southern growth, the best yields of fodder may be expected. Hungarian grass, much akin to the German millet in its habits of growth, has seeds of a dark shade.

The Golden Wonder millet is very productive of seed. The heads are uncommonly long and heavy. Because of the large yields of seed that may be obtained from this variety, it is becoming a favorite when seed is the chief object sought. And since it will ripen further to the north than corn, it may in some respects be used as a substitute for that king of fodder plants.

Broom Corn millet, or Hog millet, for it is known by both names, has also been found an excellent substitute for corn in sections where the latter will not ripen. But it may also be grown profitably in many corn growing sections. It bears a close resemblance to broom corn while it is growing, hence probably the origin of the name. It is raised more for the seed than some of the other varieties of millet, but sometimes it is raised for fodder only. When grown for the seed it should be harvested with the binder. The seed stands in high favor as a food for swine in those sections of the west where it has been tried.

Millet requires a soil rich in vegetable matter and of free texture. Loams, whether of a clay or sandy character, will produce millet abundantly. Dark prairie soils grow it admirably, and muck soils capable of proper cultivation at the right season will yield very heavy crops. Clays and sands grow it shyly, the former because of their adhesiveness and the latter because of their porous character. Millet may be sown in the Northwest any time after the corn-planting season has arrived. If sown in the early spring while the ground is cold and the season is also cold, it will not do so well as when sown later.

The season for sowing millet may be prolonged until well on into the summer, so long as the soil contains enough moisture to sustain growth. At least from sixty to seventy-five days are required to bring millet to that stage when it will make a full crop of fodder. It is very easily injured by autumn frosts,



GERMAN MILLET



HUNGARIAN.



grain and then grinding it before feeding it to live stock is certainly to be questioned when even better results may be looked for from feeding it in the straw. It is at least probable that in the near future much of the grain grown as food for live stock will be thus fed. Some farmers who have learned from their experience that in many instances greater yields may be obtained from growing grains in combination rather than singly have abandoned the practice, because they have found it difficult to separate the varieties after they were threshed. But why desire to separate them if they can be fed to live stock? When the grain is wanted without admixture cereals should never be grown in combination.

All varieties of cereals are not equally adapted to the production of fodder. The best kinds to choose are those distinguished by a vigorous growth, which produce straw of a fine rather than coarse character and which are amply possessed of the stooling quality. Happily those varieties found best adapted to the production of grain are also those generally found most suitable for growth as fodder. Some of the cereals which have been found best suited to the conditions of the Northwest will now be given.

The leading kinds of spring wheat include the Saskatchewan Fife, the Velvet Chaff Blue Stem and the Pillsbury. The first mentioned variety is too well known to require further description. The second is a bald wheat with white chaff, distinguished by a blue shade below the head before it ripens, hence the origin of the name. This variety is hardy, rugged and considerably more productive than the Fife. Originally it was from five to six days later than the latter in ripening. But through long continued and careful selection, some strains of this variety have been obtained possessed of all the good qualities of the Fife, and which ripen quite as early and yield much more abundantly. The third is a selection from the Fife and is the best type of the Hard Fife wheat.

Among the leading varieties of oats are the Lincoln, the Negro Wonder, the White Russian, the Early Archangel and the Golden Giant Side oats. The Lincoln oat was introduced to the Northwestern public by the Northrup, Braslan, Goodwin Co., in 1893. The yields obtained have been very large and in some instances extraordinarily so. It ripens early, stands up well, has a thin hull and is said to be rust proof. The Negro Wonder is a gray oat, characterized

by early maturity, stiffness of straw and good stooling qualities. The White Russian, though an old variety, is still popular where the seed can be obtained in its purity. The Early Archangel, introduced from Russia, is a very early kind and is better adapted to light soils than some of the other sorts. The Golden Giant is a side oat, which produces a long head and yields abundantly, but is somewhat late in ripening.

The leading varieties of peas comprise the Chancellor, Golden Vine, Crown, Prussian Blue, White Marrowfat and the Black Eyed Marrowfat. The Chancellor is an early and productive variety, well adapted for the Northwest. The Golden Vine and the Crown are well tried varieties which have given satisfaction to the growers. The Prussian Blue grows vigorously and yields an abundant crop. The White and the Black Eyed Marrowfats are very large and hardy varieties, the straws of which are strong and coarse.

The kinds of barley which stand high in favor include the Mansury or Mensury, the Highland Chief and the Improved Black. The Mansury, a six rowed barley, is one of the most vigorous and largest yielding varieties now grown, and was originally imported from Asia. The Highland Chief is a two rowed sort. The kernel of the grain is unusually plump and large and it is claimed that it does not discolor so easily as some other kinds. The Improved Black barley is one of the most useful kinds that can be grown for feeding purposes, and it weighs as heavily as wheat.

Whether cereals are grown for the grain or for fodder uses, the mode of preparing the soil will be essentially the same. The object aimed at in either case should be to adopt a rotation that will keep the ground as free from weeds as possible, to plough it in the autumn rather than in the spring, to plough shallow rather than deep and to sow with the grain drill rather than broadcast.

Oats.—The oat crop may be grown with much success as a fodder crop throughout all the Northwest. In dry sections where a "stand" of grass cannot be readily obtained it has been thought preferable by some farmers to grow oats instead, and to feed them in the straw either in the cut or uncut form. If raised for the use indicated it is important that they should be harvested at that stage which will secure the maximum feeding value in both straw and grain, and in order to accomplish this, it will be necessary to cut the crop when a little under-

ripe. The crop may be cut with the mower and cured in the same way as hay, or it may be harvested with the binder and cured in the shock. When oats are cured thus, they furnish excellent fodder for horses, milch cows and other cattle, and also for sheep. Those varieties will be found the most suitable which do not lodge readily, which are possessed of good stooling properties, and which also yield a fair amount of straw, fine rather than coarse in quality. Two bushels of seed per acre may be required when the drill is used, and in some instances a larger quantity.

Oats and Wheat.—Oats and wheat grown together furnish an excellent winter fodder for cattle. When used as a food for live stock there is probably no other way in which it can be grown more cheaply or fed with so much profit. The Northwest is proverbially a wheat raising country, hence there is much propriety in making wheat one factor of a fodder crop. Wheat and oats may be grown together with great success and considerably larger yields can be obtained from the combined crop, than from either grown separately. This crop can be conveniently harvested with the binder. Two bushels of seed may be used in sowing with the drill. The proportions may be varied in order to secure the result desired by the grower.

Oats and Peas.—Oats and peas when sown together furnish an excellent winter food, more especially for cattle that are being fattened, for milch cows and for sheep. The directions given in Chapter IV in growing peas and oats as a soiling crop will also be found equally applicable in growing them for winter fodder. But if desired for the latter use the crop is not ready for harvesting at so early a stage. The best time for cutting is when the grain reaches the dough state. The feeding value of the crop has then nearly attained its maximum, the straw is palatable and there is but little loss from shelling. The binder can be used advantageously when harvesting this crop but it can also be harvested in the same manner as native hay.

Oats, Peas and Wheat.—This crop provides an admirable fodder for live stock. The variety not only adds to the yield obtained, but it also gives an additional feeding value to the crop. It may be harvested with the binder. When the seed is sown with the drill, about two and a half bushels may be used per acre. The proportions of the seed in the mixture may be two parts each of oats and wheat and one part of peas.

The Everlasting Pea.—(*Lathyrus Sylvestris Wagneri*) is also known as the Flat pea and it has been but recently introduced into North America. It is rapidly gaining favor in Europe, particularly in Germany where Professor Wagner has given much attention to its improvement during late years. It is commonly mentioned as a forage plant, but it is probable that in the dry climate of the Northwest it will



EVERLASTING PEA. (*Lathyrus Sylvestris*.)

prove more satisfactory when grown to furnish fodder rather than forage. Close cropping by live stock in the early part of the season may certainly be expected to hinder its growth in the area referred to. But in the more moist sections of the continent it will doubtless serve for either forage or fodder uses. Experience in growing it in America is as

yet limited, hence it is fitting that all references bearing upon its food producing value on this continent, be made with caution.

As shown in the illustration the everlasting pea produces an immense crop of foliage. Some have claimed that it will yield at least two good cuttings a year, but in the limited experience of the writer in growing this plant in Ontario, Canada, it produced but one cutting the second year after it was sown. This one crop however, weighed at the rate of 15 tons per acre when newly cut, and results very similar have been obtained at the State Experiment Station in Michigan. The roots go down deeply into the soil, hence the plants possess great power to resist the influence of drought. The claim has also been made that they will live to a great age. The plants endure low temperatures in winter, and the foliage is not easily injured by frost. It retains its greenness until winter is at hand. As this promising plant is a legume, it possesses the power of enriching soils by means of the nitrogen which it absorbs and conveys from the atmosphere to them and as the tubercles formed on the roots are numerous, it would seem to have this power in an unusual degree. Its feeding value has been estimated equal to about twice that of red clover, ton for ton, and live stock are fond of it, whether in the green or the cured state. The hardihood of the everlasting pea as regards endurance of both drought and cold, and the readiness with which it retains its hold upon the soil are strong recommendations in its favor. But the difficulty of obtaining plentiful supplies of seed may hinder its rapid introduction, as it does not seem to bear seed abundantly.

The everlasting pea will grow on almost any free working soil with a moderately porous subsoil, and is best adapted to sandy soils. It can be made to luxuriate on light sands even, after it has been once established upon them. The sowing may take place early in the spring; it has been usual hitherto to plant the seeds in drills from twenty-four to thirty inches distant from one another, six inches apart in the drill and fully three inches deep in prairie soils. As the seed is slow of germination, that of some plant which springs up more quickly may be sown in the same drills, which will serve so to mark the line of the rows, that the cultivation may begin at an earlier period. It would seem necessary to give the everlasing pea most careful culture during the first season, after which it would doubtless be able to take care of itself. It should not be eaten off the first year. And probably more fodder

will be obtained from it if not cropped off or cut too closely in the autumn in sections of country where the winters are severe. The proper time for cutting and curing the plants is apparently when they are in full bloom.

Sacaline (*Polygonum sachalinense*).—This new fodder plant is receiving no little attention, both in Europe and North America, at the present time. Good authorities, several of whom have had some ex-



SACALINE.

perience in growing it, speak hopefully with reference to its future in the United States, and more especially in those sections where the rainfall is insufficient. It is said to have been discovered by the Russian

explorer, Maximowicz, in the island of Saghalin or Sakhalin, situated in the Sea of Okhotsk, between Japan and Siberia.

This plant is leafy in its habit of growth. It pushes rapidly onward during the season of vegetation, and when not checked by cutting it off, is capable of attaining the height of several feet in a single summer. Its roots radiate from a centre and extend so quickly that in a single year it is said they will occupy the soil over a radius of three feet. The root-stocks are possessed of numerous buds, which throw up fresh stems as they extend. It is claimed that a single young plant will produce enough root-stocks in one season to furnish a hundred cuttings.

The analysis of sacaline shows it to be possessed of high nutritive qualities. Several cuttings are said to be produced yearly, and it is claimed that live stock are fond of it.

It is further claimed that sacaline will grow in soils stony, rocky, sandy or gravelly—in a word, in a great variety of soils. It is propagated by the seed and also by cuttings obtained from the root-stocks. When cuttings are used they are simply buried in previously prepared soil to the depth of about six inches and they are planted three feet apart each way.

Sacaline should certainly be tried, but with a prudent caution at first, as experience in growing it in the Northwest is almost entirely wanting.

The Sunflower.—The sunflower is capable of producing a large quantity of food that can be utilized in various ways upon the farm. The seed provides an excellent diet for many kinds of fowls. It may also be used with advantage and profit in feeding other live stock, though but little attention has been given hitherto to raising this plant in America. The growth of the sunflower is now recommended for ensilage. When raised for this purpose the heads are removed from the stalks and run through a cutting box, so that they can be mixed with the corn which is also being placed in the silo. When thus stored the ensilage is specially recommended as food for cows giving milk, and at the same time is said to be a good food for other kinds of live stock.

Although the sunflower will thrive in nearly all parts of the continent, it is admirably adapted to the conditions of the Northwest. Possessed of great power to withstand drought, this plant luxuriates in prairie soils, grows rapidly, and will mature in latitudes north of the

forty-ninth parallel. When grown in strips in sections where the soil is liable to blow, it may be made to render excellent service in checking the sweep of the winds. And it has been claimed that a ring of sunflowers around a farm, when the plants in it stand closely together, will form an effective barrier against invasion from the Russian thistle, as it goes tumbling over the prairie.

The usual time of planting the sunflower in the Northwest is during the latter part of May, but the seed can be sown even some weeks later, when there is enough moisture in the soil to develop growth. The seed may be sown with the grain drill and the rows made from thirty to



MAMMOTH RUSSIAN SUNFLOWER.

forty-two inches apart, to suit the attendant conditions. The distance of the plants in the line of the row may also be varied. The average distance will probably be found somewhere between six and twelve inches. Cultivation between the rows should commence as soon as the young plants clearly mark the line of the row. When the cultivation given is frequent and prolonged, the yield of the crop will be greatly improved. No hand hoeing is required, other than to remove the weeds which, if left, would mature.

Although the high feeding value of the sunflower is unquestioned, and although it is now certain that very large yields may be reaped

per acre, there is still much to be learned regarding the best modes of harvesting the crop and also of feeding it.

Harvesting Hay.—The loss arising from the unseasonable and improper harvesting of hay is in the aggregate very great. And this loss is even greater possibly in the Northwest than in some other portions of the United States; for the reason, first, that in many sections the wild hay crop is still very abundant, and second, the fine weather which prevails under normal conditions in the hay-making season, has a tendency to foster carelessness in the curing and handling of the hay.

The best time to harvest hay will depend on the nature and kinds of the grasses of which it is composed, on the state of the weather, and on the use for which it is intended. With regard to the proper time at which grasses and clovers should be cut, it would be impossible to give a general rule that would apply equally to all the varieties. Some kinds ought to reach a more advanced stage than others before they are cut, and for certain uses the same varieties need to be cut at different periods of maturity. The best general rule to follow is to mow the hay when the prevailing grasses of which it is composed are in full bloom. There may be good reasons why cutting the grass should be deferred until a period somewhat too advanced for making it into hay of the best quality, for over-ripe hay well cured is certainly more valuable than hay cut at the proper season and then spoiled or partially spoiled because of adverse weather while being cured. Nevertheless the aim should be at all times to secure to the greatest possible extent the highest feeding value in the hay.

The advantages which result from cutting hay at an early rather than a late stage of growth include the following:—First, the difference in the avidity with which live stock eat hay cut at the proper stage, and the same variety left uncut until it becomes woody, is similar to the difference between eating with a keen relish and eating because compelled to by hunger. Second, when grass is thus harvested and fed to milch cows it furnishes milk more freely than if it were riper. And here a question of much importance arises, not simply because of the bearing it has upon the profits of the dairy, but because of the intimate bearing which it has upon the development of all kinds of young stock. Third, it prepares clover for being fed to horses, not only without injury but with great advantage. It is when clover has been cut over-ripe or has been imperfectly cured that it becomes trans-

formed into a ration which is hurtful to the horse. Fourth, there is no loss from the shedding of leaves or seeds or from the heads breaking off. Strip clover and lucerne of the leaves and heads, and they are shorn of their great strength. Fifth, with some varieties of clover it enables an extra cutting to be obtained. For some kinds of feeding the second crop of clover for the season is nearly as valuable as the first. A delay of one week in the cutting of the first crop may, in some seasons, make the difference between success and failure in the second crop. And these remarks apply equally when the second crop is allowed to mature seed. Sixth, it gives opportunity for an increased growth of the aftermath. A strong aftermath is valuable whether to furnish food, to mulch the ground as a protection against drought, or to shield the roots of the grass from the frosts of winter.

The object in curing hay should be to prevent exposure to dew and rain, and also to shield it from the unnecessary injury which follows when left lying too long beneath the burning rays of the sun. Rain falling upon hay while it is being made discolours it, and the extent of the discoloration is in proportion to the advancement of the stage of curing. Rain also washes out a part of the starch and other soluble matters, including a considerable proportion of the ash ingredients, so that it is rendered intrinsically less valuable for feeding purposes, apart from the loss of palatability occasioned by the absence of the aroma when hay is wet during the process of curing. Dews and fogs act similarly, but less in degree. Undue exposure to sunlight fades the hay and causes many of the leaves to become so crisp that they break off. There is probably greater loss from allowing hay to become overdry through undue exposure to sunlight than from the combined influences of rain, dew and fog.

Whether hay should be cured in the cock or coil, as it is sometimes called, depends upon the grasses which compose it, the degree of the ripeness of these grasses and the state of the weather. The various kinds of clover, when grown alone and cut in early bloom, cannot properly be cured with ease without having first been put up into those coils, or, as they may be termed, miniature stacks. But for harvesting in dry weather clover can be cured in winrows, and this can be done more particularly in the climate of the Northwest, which is proverbial for its excellent harvest weather. The grasses proper can be readily cured in good weather without putting them up into coils.

Numerous methods of making hay have been adopted. In fact variation in method is an absolute necessity to suit varying conditions. Of these the following are the chief: First, mow the hay in the morning, run the tedder over it near mid-day, rake into winrows before the dew falls, and store it away the next day. This method will answer for several varieties of grass, but not equally well for varieties of clover. Second, mow in the morning, use the tedder on the mown hay once or twice, rake and house the same evening. This method is adapted to the harvesting of grass cut when rather beyond the proper stage of maturity, and more especially in weather which is not to be relied upon. Third, mow at any time, use the tedder once or more frequently, rake when sufficiently dry and cure in coils. Hay is dry enough for being raked as soon as the labor of raking can be done without difficulty. This method is particularly suited to the harvesting of clover. In some instances clover cannot be cured in a less time than from three to six days. Before the coils are drawn away it may be necessary to open them out for an hour or two to expose them to the influence of the sunlight. The tedder is of great service in curing hay where the crop is good. When tossed into the air by the tedder the grass falls down loosely, hence the wind, an admirable agent in curing hay, has a good chance to blow through it. The hay loader is of much value when the hay can be lifted from the winrow. The hay sweep and the stacker also fill an important place, more especially in prairie countries.

The advantages arising from putting hay up in coils include the following: The fine natural color of the grass is in a great measure preserved and the aroma as well. The hurtful influences of rain and dew are either prevented in whole or in part. These influences cannot be wholly prevented unless where hay caps are used to cover the coils. These are much more essential in the east than in the west. And the hay in the coils undergoes a mild fermentation, which lessens the danger from over-fermentation when the hay is stored. The disadvantages from placing hay in coils include, first, the increased cost of the labor, and, second, the impossibility of using the hay loader when the hay is being stored.

When hay is stored at the proper stage it undergoes a slight fermentation. If stored too soon, that is, before it has been sufficiently cured, the fermentation becomes excessive and induces mould, which is very hurtful to live stock. When there are just apprehensions that

mould may be formed to some extent, the sprinkling of salt over the mass as each successive load is deposited will tend to obviate the danger. One peck of salt to each load of hay is a liberal quantity to make use of. If hay will not settle down upon itself when stored it is over-dry. An experienced haymaker can easily tell when hay is ready for storing by the way in which it handles when being pitched with the fork. It should be borne in mind, however, that as various kinds of hay differ much in weight, no little experience is required to make certain by this method that hay is ready for being stored. Another plan is therefore submitted which is simpler. It consists in taking a small quantity of the hay in one hand and twisting it around a number of times with the other. If no indications of moisture appear the hay may be regarded as ready for storing. But if the hay thus twisted is easily broken asunder, it is then over-dry.

The plan of cutting hay down and allowing it to lie where it fell, exposed to the sunlight until faded and crisp, cannot be too severely condemned. Hay cut in this fashion is little better than good straw, even though super-excellent in quality when it was cut.



CHAPTER VI.

FIELD ROOTS.

Field roots furnish an admirable food adjunct for all kinds of live stock, more especially in the winter season. Their relative feeding value is certainly greater than is shown by chemical analysis. The explanation will be found probably in the influence which they exercise on digestion when fed as a part of a ration. For maintaining animals in a condition of thrift they are thought to be superior to corn ensilage. With a goodly supply of field roots and good straw, store animals may be wintered cheaply and in fine form. They are greatly helpful in promoting muscular development, and they furnish a safe food adjunct for live stock which are being fattened, more especially cattle and sheep.

The free growing of field roots will be found very helpful in securing a clean condition of the land and also in maintaining the same. The aim should be therefore to grow them on foul rather than on clean soils. When well cared for these crops will secure to the land all the advantages of the bare fallow. Generally speaking therefore they should come after some cereal crop, such as oats or wheat, and should be followed by a crop of grain with grass seeds sown upon it.

It is somewhat surprising that in a country so admirably adapted to growing field roots, more especially mangels, sugar beets and carrots, so little attention relatively has been paid to it. The argument which claims that the relative feeding value per acre of corn and roots respectively, as given by chemical analysis, is in favor of corn, is not a sufficient explanation, for the chemist has never yet been able to give us the whole feeding value of field roots, any more than he has been able to give us the whole feeding value of oil cake.

The lack of facilities for winter storage has undoubtedly stood in the way. But, as winter fattening of live stock comes to be more practiced, room for storing roots may be provided in the basement of the

buildings erected to shelter the stock. Where the temperature gets low, and when the roots are protected simply by a stone wall laid in mortar, provision should be made for an air space between the roots and the wall. When the wall of one side of the basement is built against a bank of earth, the roots may be stored in an excavation made in the bank, but not far distant from the place where they are to be fed. They may also be stored by digging an oblong trench in the ground, where the natural drainage is good, and piling the roots in the same so as to rise above the surface of the ground like the ridge of the roof. They are then covered plentifully with straw. A light covering of earth is put on at first, more is added later when the weather becomes colder, and still later fresh manure is put over the earth. The chief objections to this mode of storage arise from the additional labor in handling which it necessitates and the difficulty in using the roots in cold weather.

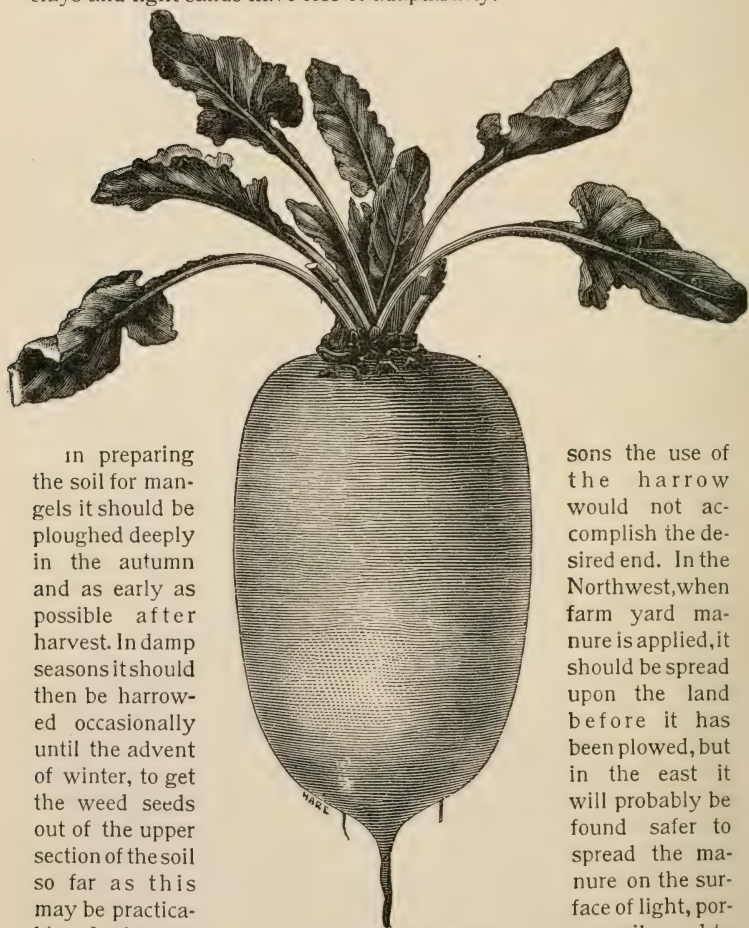
Mangels.—Mangels furnish an excellent food for nearly all kinds of live stock, such as cattle, sheep, swine and fowls, but they are especially valued as a food for milch cows, as they may be freely fed to them without the danger of giving a taint to the milk.

Mangels are of several varieties. These are distinguished by their color, as red, orange and yellow, and by their shape, as oblong and globular, and by variations intermediate between these. They are usually referred to as being of the long, intermediate or globe varieties. The former generally give the largest yields, but the latter as a rule are of a higher feeding value.

The principal varieties of mangels grown in the Northwest are the Mammoth Long Red and the Golden Tankard. The former yields heavily. The latter, an intermediate variety, will probably equal the former in weight of produce, and in quality it is superior. It is tankard in shape, the outer flesh is of a beautiful yellow color and it is remarkably clean and smooth. When cut open it shows alternate yellow and white rings. The Mammoth Golden Giant, also an intermediate variety, is of great promise. It is larger in size than any of the other yellow mangels, and is easily lifted from the ground. The red and yellow globe shaped varieties are also sold in considerable quantities.

They are admirably adapted to the soil and climatic conditions of large areas in the Northwest. They will grow luxuriantly on all deep soils rich in organic matter. Clay loams, strong sandy loams and dark

prairie soils are specially adapted to the growth of mangels, while stiff clays and light sands have less of adaptability.



GOLDEN TANKARD MANGEL.

in preparing the soil for mangels it should be ploughed deeply in the autumn and as early as possible after harvest. In damp seasons it should then be harrowed occasionally until the advent of winter, to get the weed seeds out of the upper section of the soil so far as this may be practicable. In dry sea-

sons the use of the harrow would not accomplish the desired end. In the Northwest, when farm yard manure is applied, it should be spread upon the land before it has been plowed, but in the east it will probably be found safer to spread the manure on the surface of light, porous soils, and to

allow it to remain there undisturbed until the winter is past. In the

spring the ground thus plowed the previous season will only require surface cultivation until the mangels are sown. When mangels are sown late in the season the manure may be spread over the ground in the winter and then turned under in the spring, but the labor of cleaning the crop will be much greater than when they are grown by the former method. Where artificial fertilizers are wanted, salt and superphosphate may be used, at the rate per acre of 200 pounds and upwards of the former, and 100 pounds and upwards of the latter.

In the east it has been found advantageous to grow mangels and other field roots in raised drills formed by using a double mold-board plow with a marker attached to it. A greater depth of soil is thus secured, and the labor of keeping the crop clean is also facilitated. But in the deeper and less moist soils of the west and Northwest it will probably be found more advantageous to sow them in rows on the level.

When the seed is sown in raised drills a machine is used, made for the purpose, which is drawn by one horse. It sows two drills at a time. A light roller is attached which presses the soil upon the seeds and so lessens surface evaporation. A machine adapted to the quick sowing of all kinds of field roots in rows and on the level is an invention much needed. Some grain drills may even now be thus used, but they are not as yet all that is required for sowing field roots in the very best manner. After the ground has been first marked off, some kind of hand machine is more commonly used at present, but as these machines only sow one row at a time, too much time is occupied when they are used for sowing large areas.

When mangels are sown in the spring, as soon as the ground is dry enough to allow the work to be done in good form, they generally grow to a much larger size than when sown later. But when safe germination can be ensured, good crops can frequently be obtained in the Northwestern states from seed sown as late as the beginning of June or even later. But it should always be the aim to sow the seed early rather than late. In some seasons mangels may be sown so early as to be injured by frost, but such instances are exceptional.

From four to six pounds may be named as the average quantity of seed to sow, but sometimes, as when the seed bed is cloddy or dry, it may be prudent to sow a larger quantity. If the seed is soaked from twenty-four to forty-eight hours before sowing, and is then dried quickly by the aid of ashes, sand or powdered charcoal and sunshine, it will

germinate more quickly. But when the ground is lacking in moisture such a course would be hazardous.

The distance between the rows in a crop of mangels, and also between the plants in the line of the rows will vary with the condition of the variety, the condition of the land, and the time of sowing. The larger the variety, the richer the land, and the earlier the seed time, the wider apart should be the rows and also the plants in the row, and *vice versa*. The distance between the rows varies all the way from twenty to thirty-two inches. From twenty-six to twenty-eight inches is a favorite distance.

The cultivation should commence soon after the plants have got well above the surface of the ground. At first it may be deep, and should come as near as possible to the plants, but not so near as to disturb them. As the season advances the cultivation should be shallower and more distant from the plants. It should also be frequent and should be continued until the leaves of the mangels extend so far laterally that further cultivation would break some of them off. It must then cease.

The thinning of the crop should commence soon after the mangels have reached the rough leaf stage of growth, that is to say when they are but little more than two or three inches high. And it is highly important that the work should be all done within a short period, or the labor of thinning will be greatly increased, and the growth of the plants not yet thinned will be much hindered. When the season is not far advanced, and when there is also a prospect of an abundant growth, the plants may be thinned to a distance of fifteen inches, and in exceptional instances to even a greater distance. Under some conditions they need not be thinned to a greater distance than four inches. From ten to twelve inches may be mentioned as an average distance. Much of the work of thinning is done by the aid of the hoe, but some hand work is required, and the workman should stir all the soil unbroken by the cultivator to prevent the rapid growth of weeds, and to hinder the escape of ground moisture. A second thinning is necessary a few weeks later to remove all plants which may be growing in clusters, save one in each, and to remove weeds found in the line of the row. In thinning all kinds of roots the aim should be to leave the strongest plants. It is simply folly to allow any weeds to ripen in a root crop. When it is thus managed the land is in a

splendid condition for growing a grain crop, and without any further plowing.

Mangels are ready for harvesting when the leaves cease to make further growth and when a considerable proportion of the lower ones fade and become crisp and dry or fall off. But they should in any case be harvested before the frosts become severe enough to stiffen any part of the soil, or they will harm that portion of the mangels above ground, to the extent of injuring their keeping qualities. They are commonly pulled by hand and laid in heaps conveniently distant. Each heap has two rows. The mangels in these heaps are laid in regular order, tops outward, for convenience in handling when removing the tops. These heaps contain the mangels from an even number of rows, as four, six or eight. If they should pull hard, a plow furrow turned away from one side of the row will overcome the difficulty. The tops may be removed by the use of a heavy knife with a long blade, or by simply wringing them off with the hands. The latter mode is preferable when it can be done, since it does not injure the keeping qualities of the mangels. They are thrown in heaps in which they are allowed to remain for a few days, as, if drawn at once to the place of storage the fermentation would be considerable, enough probably, when stored in large quantities, to injure to some extent the keeping qualities of the roots. While they remain in the field they should be carefully covered with the tops to protect them from the frosts, and to preserve what may be termed a freshness of bloom in their appearance.

Although mangels may be fed to live stock at any time after they have been harvested, and even before that period, their feeding value increases for some time after they have been removed from the earth, owing to certain chemical changes which go on for a time within the substance of which the roots are composed.

Sugar Beets.—Sugar beets make an excellent food for live stock. Owing to the higher percentage of sugar which they contain, they make a better food for animals that are being fattened than other kinds of field roots. They would be more in favor as a food for live stock were it not that they require more labor to grow them, acre for acre, than either mangels or turnips, owing to the smaller size relatively of the roots and the greater number of rootlets on the same. These peculiarities of growth increase the labor of thinning, of harvesting and of storing.

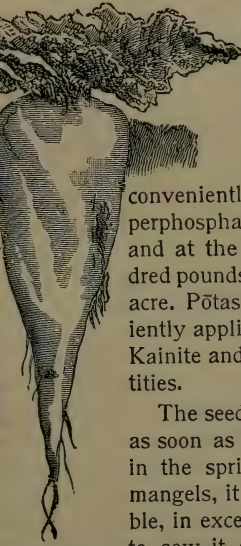
When sugar beets are grown as a food for live stock, preference is given to the larger varieties. When they are grown to furnish sugar for household uses, those varieties are chosen which are rich in sugar producing qualities. When grown for the former use, the mode of production is essentially the same as in growing mangels, with the difference that the beets are grown more closely together than the mangels. With the exception instanced, therefore, all that has been previously said with reference to growing mangels will apply equally to the growing of sugar beets for the purpose indicated. The soils even that are suitable for one will in the main be found suitable for the other. It will, therefore, only be further necessary to name the varieties which stand highest in favor with the growers. These are the Champion Sugar Beet and the White Silesian. The first mentioned is an improved variety from France and affords a high percentage of sugar. Because of its productiveness and high sugar-making qualities, it will answer well to be grown for stock feeding or the sugar factory. When grown to furnish sugar, some important variations arise in soil conditions and in the treatment of the soil and the crop. These variations will now be noticed. But before treating of them it may be mentioned, first, that the varieties which stand highest in favor for sugar production include, in addition to those named above, Lane's Imperial and Vilmorin's Improved. These are standard sorts, the excellence of which has been well proved; and, second, what will now be said with reference to sugar beets will apply only to growing them for the production of sugar.

Sugar beets may be successfully grown on loams, mild sands or clays, alluvial soils and dark soils of the prairie, providing they are fairly rich and are underlaid with sub-soils only moderately porous. Mild, moist, sandy loams are the most suitable, more especially when organic matters, clay and silica are suitably blended in them. Stiff clays, leechy sands and virgin soils are the least suitable, more especially when the latter are rich in organic matter or contain alkaline salts in any considerable degree. Any soil that will produce a good crop of corn, wheat or potatoes should, with suitable cultivation, be made to produce a good crop of sugar beets.

Generally speaking the mode of preparing the soil for mangels will be the mode to follow when preparing it for sugar beets. The variations relate rather to fertilizers than to tillage. Sometimes barnyard

manures are applied alone. Sometimes, and more especially in the east, only artificial fertilizers are used, and sometimes both are used in conjunction. Manure from horses is good, that from cattle is medium, but manure from sheep is not good. When farm-yard manure is used it should be well fermented and should be applied in the autumn previously. It would be safer even to use the manure with the previous crop. For instance, when barley precedes the beet crop the manure should be applied before sowing the barley. It then has time to become well mixed with the soil and is less

liable to produce a rank growth of the beets, which would result in a decreased percentage of sugar in the crop. Artificial fertilizers are applied in the form of nitrogen, phosphoric acid and potash, and sometimes, but less frequently, as magnesia and lime. While it is important that there should be enough of nitrogen in the soil to produce a maximum crop, it is even more important that there should be a plentiful supply of phosphoric acid and



N., B., G. Co.'s
Champion
Sugar Beet.

potash because of the influence which they exert upon the quality of the beets. Phosphoric acid may be

conveniently applied as superphosphate or basic slag, and at the rate of one hundred pounds and upwards per acre. Potash may be conveniently applied in the form of Kainite and in similar quantities.

The seed should be sown as soon as the ground is dry in the spring, but, as with mangels, it would be possible, in exceptional instances, to sow it so early that the young plants would be injured by the frost. It would

be unwise to sow the seed late in the season, for, even though a maximum crop in weight should be obtained, there would not be time for the crop to ripen properly, hence it would be markedly deficient in saccharine properties.

Where sugar beets are grown on a large scale, as for sugar factories, the seed is sown with machines made for the purpose. They plant several rows at a time. The rows are on the level, and there is no need for having them wider apart than from fifteen to eighteen inches. Not less

than eight pounds of seed are used per acre, and in some instances even a larger quantity is sown. The seed requires to be covered to a depth varying from one-half an inch to four or five times that distance, owing to a difference in soils, in soil conditions and conditions of climate. And the same is true in degree of all kinds of the seeds of field roots. As a rule they may be more deeply buried in the west and Northwest than in the eastern part of the continent, and also in prairie and sandy soils than in stiff clays.

Cultivation with the horse hoe, or, as it is more commonly termed, the cultivator, should begin as soon as the young plants distinctly mark the line of the row. As with mangels it should be deep at first and shallower and narrower as the season advances, and should be as frequent as once a week for from six to eight weeks from the time that it began. If it were to be continued longer the beets would be encouraged to continue to grow, hence what is termed saccharification or sugar-forming in the roots would be hindered. This process is active in the later stages of the growth of the root. Slow development and completed development are favorable to it, hence dry and moderately warm weather is desirable during what may be termed the ripening period of the beets. Particular care should be taken during the cultivation not to injure the beets or their tops.

The thinning may begin as soon as the plants have acquired four leaves. They may be thinned from seven to ten inches according as the rows are near to each other or more distant. It is important to save strong plants at the risk of varying the distances somewhat. The hand hoe should of course be used in the line of the row in conjunction with the thinning, and the aim should be to keep the whole of the root covered throughout the season, as any portion exposed above ground is practically valueless for sugar-making uses. It is not desirable to have the roots weigh more than from one to one-and-a-half pounds each, hence the advantage in having them planted closely and in having no blanks so far as this may be prevented.

The beets are ready for being harvested as soon as a considerable proportion of the leaves die, while those which remain turn to a yellowish-green and some of them show indications of drooping. Harvesting should be deferred as long as possible without unduly hazarding them to injury from frosts.

When grown for the sugar factory they are first loosened by an

implement drawn by horse labor which runs underneath them and so loosens them. They are then raised by hand and topped with a large knife which removes the portion of the beet to which the stems adhere. This part though valuable for live stock is of no value for making sugar. The roots are thrown into piles and covered with the tops until they are drawn away.

The siloing or pitting is usually done by the factory, but it may also be done by the farmer as now described. An oblong trench is dug in the soil to the depth of from one to two feet. A spot should be chosen where the drainage is good. The trench is then filled with roots and the beets are then stored upward above the level of the trench in the form of a ridge roof. In the ridge portion of the heap the heads of the beets are turned outward to prevent the soil from penetrating into the mass of roots when it is put over them. They are then covered lightly with earth. A small space at the ridge is left without earth upon it for a time, to secure ventilation. It is covered by two boards nailed together so as to make an inverted V to keep out the rain. No straw is used as it would give trouble when the beets are being manufactured. More earth is added later and as winter draws near a covering of manure is applied.

Turnips.—The Swedish varieties of turnips are more commonly known in this country as rutabagas. The term turnips has, however, been advisedly chosen to introduce this crop, as it is the more comprehensive of the two. Turnips are of two classes, viz: those of Swedish origin, commonly called Swedes, and Fall turnips. The former have flesh of firmer texture and are in consequence possessed of better keeping qualities. They may be known by the color of the top of the bulb which is more commonly purple, but sometimes green or purplish green, and by the leaves which are of a darker color than the fall varieties. The latter vary much in the comparative strength of the tops, and in the size, color, shape and texture of the bulbs.

Turnips furnish an excellent food for live stock, more especially in those portions of the year when succulent food is not to be had. When, however, they are fed freely to milch cows, and more especially in conjunction with rich foods, they give an unpleasant odor to the milk and offensive taint to the butter. But those evils are lessened when the turnip portion of the ration is withheld until after the milk has been withdrawn from the cow, morning and evening. Caution should also

be exercised in feeding turnips to pregnant ewes in winter. Although opinions differ on this question, it is probably true, that while a light ration as one or two pounds per day may prove highly beneficial to the class of stock named, a heavy ration would be harmful to the well-being of the lambs. But turnips, like all the other classes of field roots, are most excellent for producing a large flow of milk, and like these also are very helpful in keeping the system in tone

The climates best adapted to turnips are those of a moist and cool character. They do not so well withstand the heat of summer as other varieties of field roots. Usually the principal growth made by turnips is in the autumn, when the weather is moist and cool. Hot winds are seriously hurtful to them. While turnips grow admirably in the New England states and moderately well in the northern states further to the west, there is some doubt as to whether equally certain results may be looked for from this crop in the Northwestern states. This doubt is strengthened by the fact that the weather is oftentimes so dry at the proper season for sowing turnips that germination of the seed cannot be secured. It does not follow, however, that excellent crops may not be raised over all the Northwest on suitable soils and in favorable seasons. But the same absolute dependence cannot be placed in the turnip crop as in mangels, sugar beets and carrots. Those portions of the Northwest which get the largest amount of rainfall in summer will grow the best crops of turnips.

The soils best suited to the growth of turnips are those of a free-working, loamy character. They should be deep, free from stagnant water and susceptible to minute division. Turnip soils, therefore, require a fair proportion of sand in them, and yet not so much as will render them poor. Good crops of turnips may be grown on stiff clay soils, in favorable seasons, but at an undue expenditure of labor. Muck soils and those even which have an excess of vegetable matter are not favorable to the growth of turnips, as they produce an excessive growth in the tops, with a corresponding deficiency of growth in the bulb portion of the root.

Turnips are distinguished by differences in their habits of growth, as for instance variations in shape, size and color. Commonly they are in shape what may be termed a globular oblong, and this is true more particularly of the Swedish varieties. Some of the Fall varieties are of a peculiarly flattish shape. They are further distinguished by

earliness and lateness in maturing and also by their chemical composition. The number of varieties is now very great and it is continually increasing,

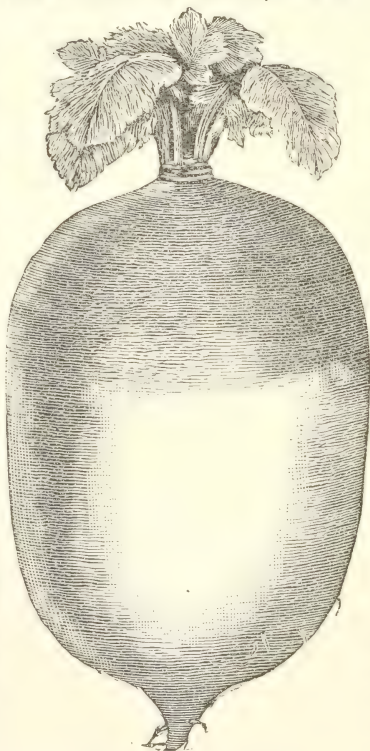


N., B., G. CO.'S PRIZE WINNER RUTA BAGA.

In the Northwest the Swedish, that is to say, the rutabaga varieties, are at present by far the most popular, and in all probability they will remain so. Of these the kinds most in favor are the Purple Top,

Yellow Fleshed Rounded varieties, of which there are many strains. They are nearly identical in form, in color and in other qualities. The N., B., G. Co.'s Prize Winner is an excellent form of this type. Carter's Hardy Swede and Skirving's Swede, similar in shape and color are both good. The Monarch Swede, Elephant or Tankard, as it is

known by each of those names, has been recently introduced from England, and is gaining favor wherever grown. It usually attains a larger size than any of the varieties previously named, and it is thought will yield more to the acre. The Sweet German, a well known and popular sort, has flesh remarkably sweet and tender. Among the leading fall varieties may be named the Jersey Navet, the Purple Top Strap Leaf, White Flat Dutch Strap



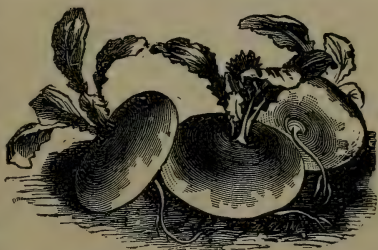
MONARCH RUTA BAGA.

Leaf, Red Globe Norfolk and White Norfolk.

The preparation of the soil required for a crop of turnips is virtually the same as for a crop of mangels, with the difference, however, that the application of the manure may be deferred until the winter season in all instances where it is so desired. When the manure is thus applied, however, the ground would require plowing again in the spring. The aim both in the autumn and in the spring

should be to clean the land from noxious weeds and weed seeds, so far as this may be possible, and it is best accomplished by stirring the land frequently more or less deeply as occasion may require. The proper preparation of the land for a turnip crop will be found peculiarly

helpful in freeing the land from weeds. The cultivation in the autumn goes far toward freeing the section of the soil that is then uppermost from the presence of these noxious intruders. And the cultivation in the spring before sowing the crop will go far toward securing a similar result with the section of the soil which was underneath in the fall, but which was placed uppermost by the plowing in the spring. The spring ploughing should take place early to facilitate the decay of the manure, and to lengthen the period for occasional shallow surface cultivation in the spring. Such cultivation will facilitate the retention of ground moisture, hence there is less difficulty in securing germination in such soils when the weather is dry.



Purple Top Strap Leaf Turnip.

Superphosphate and salt stand high in favor among commercial fertilizers for applying to the turnip crop. These manures may be used at the rate of two hundred pounds of each and upward per acre. They may be sown on the land just before it is harrowed for the last time pre-

vious to sowing the seed. In conjunction with moderate dressings of farm yard manure they usually prove satisfactory.

The time for sowing the seed is somewhat dependent on the location and climate. In the Northern states, from Michigan eastward, and in Canada,



White Flat Dutch Turnip.

from Lake Huron to the Atlantic, the favorite time for sowing Swedish turnips is from June 10th to June 25th, and for sowing Fall turnips from July 1st until well on in August, according to the use for which they may be desired. In the Northern states west from Michigan a somewhat later period would probably be safer than an earlier one, but the season of sowing would probably have to vary more

in the west than in the east in order to obtain periods of sufficient moisture to secure germination of the seed. In states lying further to the south than those named, it would be well probably to still further postpone the time of sowing, as turnips will not flourish in temperatures where the air is hot and lacking in moisture.

As with other kinds of field roots turnips should be sown in rows and on the level. The distance between the rows and between the plants in the row, as with mangels, will vary with soils, soil conditions, the time of sowing the seed and the variety of the turnip. The rows, as with mangels, may vary in distance from twenty to thirty-two inches, but from twenty-six to twenty-eight inches is the distance more commonly fixed upon. When there are indications of an abundant yield, the plants are frequently thinned to a distance of from twelve to fifteen inches in the row and to even a greater distance. But on the other hand there may be instances where a larger yield would be obtained by leaving a plant every four inches in the row. From ten to twelve inches may be named as applicable to a majority of instances.

The seed may be sown in the same way as that of other field roots. It may be that some grain drills will do the work with sufficient accuracy. With others not so well adapted to the work, the seed may be first mixed with some more bulky substance, as coarse, dry earth. From two to four pounds of seed per acre are used; when all the conditions are favorable a less quantity of seed than two pounds will suffice.

Cultivation with the horse hoe should begin as soon as the young plants are well on into the rough leaf. As with other field roots it should be deep and wide at first but more shallow and narrow as the season advances. It should be frequent and continued until it can be no longer done without injury to the plants.

The plants may be thinned with less labor probably when they are not more than three inches high. In all instances the cultivation of the plants should commence earlier than the thinning. Great proficiency may be developed in this work by care and practice, insomuch that an expert can go from one end of the row to the other in a long field without stopping to pull a weed or a turnip. The work of thinning is done by using a hoe with a wide and short blade. The person using it strikes first by drawing it toward him, and then by pushing it from him on the other side of the drill. With each stroke the turnip in the drill next to the disturbed earth falls along the drill where the

earth has been removed, and the next stroke removes the earth, weeds and the turnips not wanted from the other side of the prostrate plant, which soon rises again. The crop should be gone over a second time with the hoe to secure the "singling" of all the plants and to remove any stray weeds.

Turnips do not require to be harvested until winter is not far distant, but the aim should be to have them stored before the weather becomes so unpleasant that the work of harvesting them will prove disagreeable and irksome. Sometimes the tops are cut off with a sharp hoe and the roots are turned out of the ground by driving a heavy harrow over them. They are then drawn at once to the place of storage. This method is speedy, but the objections to it are that it tears the roots to some extent and soils the tops so that their feeding value is lessened. And when the roots thus lifted are stored they have more earth mixed with them, hence they do not keep quite so well. At other times they are pulled and topped at once and are left lying in a string-like row from end to end of the field. Four rows of the unpulled turnips may thus be conveniently made to form but one row of those pulled. This method does the work neatly and in fine form, but is considered slow. And yet again, they are pulled and laid in heaps, after the manner pursued in pulling mangels, which has already been described. When stored properly the Swedish varieties will keep for a long time. Undue warmth will soon injure them in various ways, as by sprouting and causing a mould to gather on them,

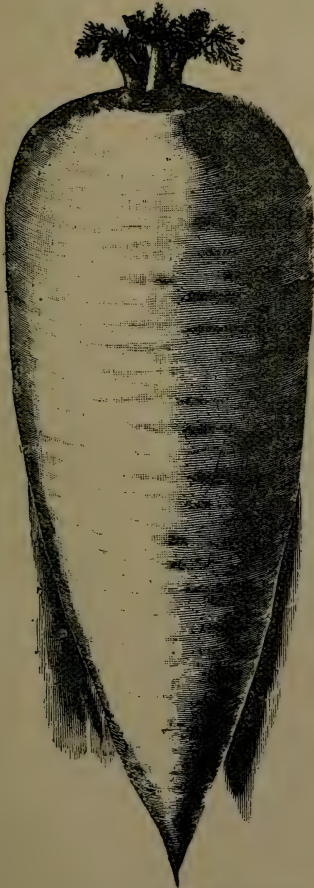
There is another mode, however, of growing turnips, viz., by sowing them broadcast and on new lands, whereon the more offensive, noxious weeds have not yet entrenched themselves. This mode is probably the only one commonly followed by the farmers of the Northwest. It has already been alluded to in Chapter IV., when dealing with the growing of turnips for forage uses. But in time it will probably give place to drill or row culture in growing crops for winter storage, since it requires new and rich land to make it successful. On poor land the turnips will not attain sufficient size to make the crop profitable in the absence of horse hoeing, which could not be attempted in a crop thus grown; and on old soils the weeds would be likely to overshadow the turnips. Moreover there would be an undue proportion of small turnips from lack of thinning, and this would greatly increase the labor of handling when harvesting and storing the roots.

While, therefore, it may be well in the meantime to grow turnips thus, even for winter storage, so long as new lands are to be had, this mode of raising them is peculiarly adapted to their growth for forage uses. It is probable, therefore, that the Fall varieties will be found ultimately to answer this purpose better than the Swedish varieties, since they grow more rapidly.

Carrots.—No root crop can be grown with so much certainty of success throughout all the Northwest as field carrots. Nor is there any root crop so free from the attacks of disease and insect pests. Carrots are much relished by all kinds of farm stock, and are excellent for them when fed as a part of the ration. They are particularly beneficial to horses at that season of the year when they are deprived of succulent food, and may also be fed with the utmost freedom to milch cows without any danger of giving an unpleasant odor to the milk, or taint to the butter made from it. A carrot crop when grown on average soils will not take injury from the frosts of spring or autumn, and has much power to resist the influences of the drought of summer, so that when it has been well started early in the season a fair return may be looked for with almost unfailing certainty. In view of these facts it does seem unfortunate that any farmer who keeps live stock, in the east, north, west or center of this Republic should permit a single season to pass without growing a plot of carrots, be it large or small, for the use of his stock. But it may be that the labor of handling has been a serious barrier.

Carrots are adapted to a wide range of soils. Almost any kind of soil with a fair amount of plant food in it will give a crop of carrots. Nevertheless the favorite soils for this crop are those of a deep, sandy and loamy character, or such as are composed largely of vegetable mould and capable of retaining moisture in a fair degree. But some varieties are at least measurably adapted to shallower and heavier soils. Owing to its deep habit of growth the carrot requires soils without excess of moisture in the subsoils. When the soil is cloddy or stony or shallow there is a tendency to produce prongs in the roots grown upon it.

There are many varieties of the carrot in cultivation. They are distinguished by their shape, as long, medium and short, and by their color, as red, orange and white. The long varieties are somewhat losing favor owing to the difficulty found in harvesting them, and for



N , B., G. Co.'s Mastadon Carrot.



N., B., G. Co.'s Victoria Carrot.

the further reason that they do not now yield such large crops as some of the other varieties. Among varieties which have become prominent in the Northwest, none stands higher in favor than N., B., G. Co.'s Mastadon. It is of the short class, and gives the greatest yield per acre of any carrot now grown. The roots are short and heavy at the shoulder, hence they are easily harvested. Nor are they liable to break when being pulled or stored. The roots often measure from fifteen to twenty inches in circumference, and a crop of from eighteen to twenty-five tons per acre has frequently been grown. The quality is also good, as the flesh is white, crisp, solid and of sweet flavor. It is a great improvement on the white and green fleshed Belgian kinds which have been the standard varieties in the past. It is not only more productive, but is much more easily handled. Northrup, Braslan, Goodwin Co.'s Victoria Carrot is considered the largest and heaviest cropping yellow variety. It is thought by many to be the largest, best formed and most nutritious of the orange or yellow varieties of carrots now grown. Although it is not quite so easily harvested as the Mastadon, some growers prefer it on account of its color. Denver's Half Long Carrot, a short variety, is properly speaking a garden carrot, but owing to its fine and sweet quality, the firm character of its flesh and the ease with which it is harvested, it is sometimes preferred to the larger sorts. It grows smoothly and handsomely, and is of a dark orange color.

In preparing the soil for carrots nearly the whole of the work should be done the previous autumn. The handling of the soil in the autumn may be the same as described in preparing it for a crop of mangels. In the spring the soil will only want to be stirred with a cultivator or harrow, or probably with these implements in succession, prior to the sowing of the seed. It is specially important to remove the weeds and weed seeds from the upper section of the soil the previous autumn, as there is no opportunity for doing it in the spring before the crop is sown.

Carrot seed should be sown as early as possible in the spring. This root requires the whole of the growing season to perfect its growth. There is no danger that it will receive injury from spring frosts. Good crops may sometimes be secured when the seed is sown at an advanced period of the spring, but they are by no means so certain as when the crop has been sown early.

The seed may be sown with a hand machine when small areas are

grown. When sown in raised drills the same machine will sow carrots as is used for sowing other kinds of field roots. When large areas are sown a grain drill may be used. With some grain drills it may be necessary first to mix the seed with some dry substance, such as earth or ashes. But when a grain drill is used in sowing any kind of field roots, great care must be taken to make the rows as straight as possible, or the labor of cleaning the crop will be greatly increased.

Carrot seed is slow of germination, and therefore its growth may be hastened by soaking the seed before it is sown. It may be soaked after the method already given as suitable for soaking mangel seed. But the soaking of the seed of any kind of field roots should be avoided when the ground is not moist. To treat it thus at such a time would be almost certain to ensure its destruction.

Carrot seed is not only a long time in coming through the ground, more especially in the early spring, when it should be sown, but it grows slowly for some time after it has appeared, hence there is great danger that the weeds will get ahead of the carrots. To avoid this danger the plan has been adopted of sowing some turnip seed along with the carrot seed. The turnips come up more quickly and mark the line of the row, so that the fight with the weeds may commence at an earlier period than would otherwise be practicable. From two to four pounds of seed are used per acre. When all the conditions are favorable the first-mentioned quantity will be enough.

The distance between the rows is varied much by those who grow carrots. From fifteen to eighteen inches will suffice for the needs of the crop, but they are more frequently grown with twenty-four inches between the rows, because then it is easier to get a cultivator sufficiently narrow to use in keeping them clean. Where but a few rows are grown alongside of other field roots, it may be found convenient to have the same distance between the carrot rows as between the rows of the other crop.

The cultivation of the crop should commence as soon as the carrots in the line of the row can be traced. The plan of cultivation recommended for the other kinds of root crops which have been previously discussed will be suitable for the carrot as well. And it may be prudent, also, to stir the soil with a hand hoe along both sides of the row and close up to the line of the carrots. The only weeds that are thus allowed to escape for the time being are those in the direct line of the

row. The work of thinning at a somewhat later period is thus rendered easier.

Much diversity of opinion exists as to the extent to which carrots should be thinned. The amount of thinning will depend on such considerations as the character of the soil, the distance between the drills and the use which is to be made of the carrots. The plan is sometimes adopted of growing crops without any thinning. Good crops, that is to say, good yielding crops, have been grown thus. One would naturally imagine that a crop of carrots grown without being thinned would be destitute of large ones, but such is not the fact. Yet along with the large ones there will be many small ones, hence when the crop is to be stored for winter feeding the labor of removing the tops and of handling the carrots is very much increased. The large roots only may be selected, however, for storing, and the small ones, along with the tops, can be fed during the late autumn.

An average distance when carrots are being thinned would leave the plants from four to six inches apart, although the distance varies from two to eight inches. Larger yields will probably be obtained from carrots thinned to only two inches apart than from those thinned to a greater distance in the line of the row, but the crop then requires more time to harvest and store it than when it has been thinned more severely.

Carrots do not need of necessity to be harvested until winter is approaching, as the crop is very hardy, but they should be safely stored away before bad weather arrives, to avoid the disagreeable task of trying to harvest them at such a time. In lifting them a plough furrow of sufficient depth may be turned away from each row. The carrots are then lifted by hand and placed in heaps, as indicated when describing the lifting of mangels. The tops are removed in the same way and the carrots may also be similarly stored. They possess fine keeping qualities, hence, when properly stored, they may be kept fresh and fit for use until the end of spring and even into summer.

Artichokes,—The opinions even of practical men differ much as to the value of artichokes in the economy of feeding, but it is more than probable that this difference of opinion is the outcome of the difficulty which some have experienced in getting the soil entirely free from them where they may have been grown. That trouble has arisen from the source mentioned is certainly true, but if the ground on which

the artichokes have grown can be turned into a hog pasture for a time the artichokes will soon disappear. A summer fallow, properly managed, will also remove them.

There is undoubtedly a place for artichokes on many farms, and it is even probable that they will yet be grown over wide areas of the Northwest, more especially in those subject to long periods of dry weather. They will grow in nearly all classes of soil, from stiff clays to light sands, but, of course, not equally well. Several hundred bushels per acre may be obtained from a single crop, even on medium soils, when they have been properly grown. They are generally grown to provide food for swine, but may also be fed with advantage to other kinds of farm stock. Chemical analysis gives them a feeding value nearly equal to that of po-



Large White French Artichoke.

tatoes and field roots, as turnips and mangels, and as freezing and thawing out again do not apparently injure their feeding qualities, they may be harvested by the hogs in the field. The exercise which the hogs get while thus engaged is peculiarly beneficial to such of them as are kept for breeding.

There are a number of varieties of artichokes and several of them have merit. The variety known as the Improved White French is one of the best.

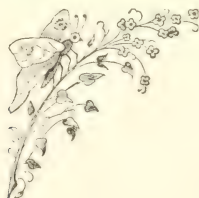
Various methods of planting have been adopted, but the following is one of the best:—

Plow the ground to a good depth and then harrow until a fairly level surface is obtained. Make shallow furrows varying from two to four inches in depth according to conditions, and about three and a half feet apart.

Cut the tubers into small pieces or sets before planting them. Drop them into the furrows that have been opened and about eighteen inches apart. Cover as soon as possible with the plough or harrow. From six to eight bushels of seed will plant an acre.

The cultivation is much the same as that required for corn as described in Chapter V. Care must be taken not to cultivate deeply as the roots extend. In some instances two or three successive crops are grown upon the same land without planting the seed more than once. When not harvested too closely the plants will come up quite thickly enough to furnish a crop. But to obtain these crops in good form the ground should be ploughed and harrowed every spring. The artichokes will come up all over the soil. When a few inches high they should be harrowed with a light harrow. The cultivator should then be run through the ground both ways so as to leave the artichokes in hills like corn.

The crop is ready for being harvested two or three weeks after the blossoms fall. It may be harvested either fall or spring as may be desired. If the hoes are unable to finish the harvesting in the autumn, they may complete the same in the spring.



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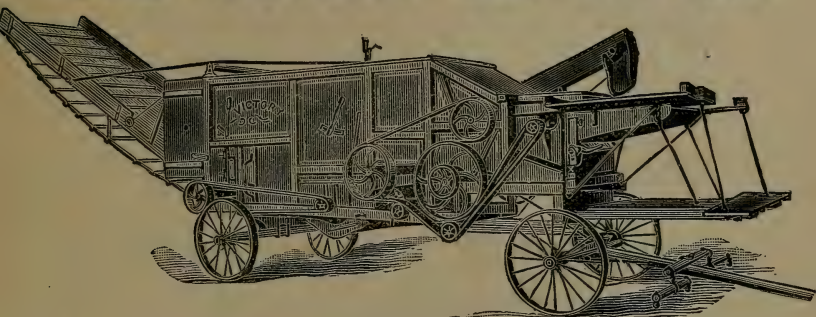
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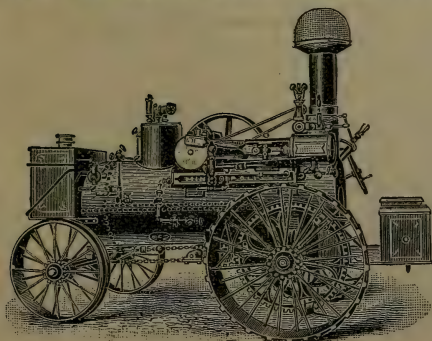
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